NATIVE STATES.

INDIAN IRRIGATION COMMISSION.

MINUTES OF EVIDENCE.

INDIAN IRRIGATION COMMISSION, 1901-02.

NATIVE STATES.

PRESENT:

SIR COLIN SCOTT-MONCRIEFF, K.C.M.G., C.S.I. (*President*).

Members.

Hon'ble Mr. DENZIL IBBETSON, I.C.S., C.S.I.

Mr. T. HIGHAM, C.I.E.

Hon'ble Mr. RAJARATNA MUDALIAR, C.I.E.

Hon'ble Mr. MUIR-MACKENZIE, I.C.S. (*Mysore and Hyderabad only*).

Mr. W. B. GORDON, M.I.C.E. (*Secretary*).

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JAIPUR.

AJMER.

RAJKOT.

Supplementary Memos., etc.

NINTH DAY.

Jaipur, 18th November, 1901.

WITNESS No. 1.—COLONEL JACOB, C.I.E., State Engineer, Jaipur.

Witness put in the following documents:—

1. Statement of existing Famine Protective Works, Jaipur State.

2. Do. do. of proposed works.

3. Memorandum (dated November 1901) on Irrigation Works in the Jaipur State with statements and plans (Nos. 1 to 8).

In reply to *the President*, the witness said:—

1. The work of construction on the irrigation tanks in the Jaipur State is done at the rates ordinarily current in the State. There is no forced labour or pressure of any kind; work is done generally through work agents, who are supplied with all tools except perishable articles, such as baskets, string, etc., and are paid a commission or percentage on the work done—the rates payable to labourers in every case being fixed by the engineers, according to the nature of the soil and local circumstances. In some places work has to be done by daily labour.

2. Small tanks are of no use as a protection against famine. They give employment and store a little water in ordinary years and may assist wells in dry years. There is, however, no minimum as to the size of the tank which it is worth the State's while to consider. It is advisable to stop every drop of water, where it is possible to do so, and it can be done at a reasonable cost.

3. It may be possible to store water in many places along the line of a river or a canal, by making cuts to natural depressions or to village tanks and so ensure a supply of water every year.

4. The canals from the Kalegh Sagur and from the Chaparwara Sagur are instances which show how the irrigation canals may be sometimes useful as the means of conveying surface drainage in the rains to village tanks beyond. The Kalegh Sagur Canal is taken off the right bank of the River Bandee, where a masonry weir 15 feet high has been built to raise the water to the canal.—The reservoir (Kalegh Sagur) is 7 miles higher up the river. Until the canal reaches the watershed, it has higher ground on its right and it crosses several small nullahs. Every one of these has been bunded up by the canal crossing it. The canal has a bank on the left side only—the right side is left open, so that all surface water from the higher ground in the rains, after filling up the nullahs to the level of the canal bed, passes off by the canal to fill village tanks—instead of going to waste as it did formerly. Another advantage is that in process of time, these nullahs silt up and the ground can then be cultivated. Bunding up these nullahs causes percolation into the surrounding soil and so benefits any wells near. Previously these wells would perhaps have been drained by these nullahs in the course of time. Similarly, with the Chaparwara Sagur Canal—it follows the general contour of the ground and has a large area, several square miles of country, above it, the surface drainage of which mostly passed off formerly to waste. The irrigation canal intercepts all this and leads it to village tanks—sluices being placed at intervals to allow it to pass off where required to tanks. After the rains both canals are used for irrigation to lead the water from the storage reservoirs to which they belong to the fields—so that they perform a double purpose.

5. As regards silt, it is advisable to make the tanks so high—if it can be done at a reasonable cost—that one can afford to ignore the existence of silt. Eventually a flat alluvial plain might be formed which would be profitable to cultivate. Silt may be diminished by checking the velocity up above by constructing dams to control the water and letting it out gradually as required. The bund constructed at Gerowli called "Madho Sagur" (described in paragraph 36, page 10 of my printed memorandum) is an instance.

6. The Banas project (printed memorandum on this shown and submitted to the President) would not pay as regards Jaipur alone. It would chiefly benefit the Tonk State. The discharge of the Banas in flood is about 700,000 cubic feet a second. In November 1883 only 149 cusecs at the site of proposed weir. *Col. Jacob.* 18 Nov. 01.

December	1883	103
January	1884	74
February	„	38
March	„	9
April	„	dry.

A storage reservoir would be necessary to make the project complete. (See paragraph 47, page 16 of my printed memorandum). No use is now made of the Banas river for irrigation purposes, and it is not known as yet whether it is possible. I have had nothing to do with the River Chambal.

7. As an instance of tapping a river a weir has been made on the River Mashi, which rises in the Kishengarh State, at a place near Etagoi where the river enters the Jaipur State. (See paragraph 43, page 13 of my printed memorandum). A canal 30 feet wide has been made on both banks to lead the flood waters to storage reservoirs—one 23 miles, the other 12 miles in length—the latter is not quite finished. Has known of no works made by the co-operation of Native States.

8. The value of water is shown by the readiness of one State to complain of another, interfering in any way with its water.

9. The prevailing depth of wells is 25 to 40 feet generally in the Jaipur State; towards the Bickaner border the spring level is down to 200 feet or more. Owing to the scarcity of rain of late years the level of the water in the wells in the town of Jaipur has fallen about 12 feet below what it was formerly. The recent famine has given a stimulus to wells.

10. The State make advances and some wells have been recently made—in some cases by the Public Works Department. Rs. 2,90,976 were advanced by the Durbar during the past year as takavi, free of interest.

11. Would make dams as high as circumstances permit; often it is better to do this than to spend money in cutting down rock to form an escape; so as to impound all the water it is possible to secure in a year of heavy rainfall—if it could be done at a reasonable cost. I would not try to retain water for two years, as so much is lost by leakage and evaporation, and then if a year of good rainfall occurs the second year, water might escape which would otherwise have been impounded. We should lose this, as well as the benefit which would have been gained by using the water which had been left in the reservoir.

12. *To Mr. Higham.*—Speaking from memory, the effect of tanks on wells extends from ½ to 1 mile or more; the water in a canal also affected wells 500 yards distant on either side, but this depends much on the nature of the sub-soil.

13. When a tank is made by putting a bund across a nullah there is sometimes a good deal of leakage down the bed of the nullah: this may often be utilised below by lift, or a small subsidiary weir may be made below which would catch all leakage and enable it to be used by flow or lift.

14. The average total area which has hitherto been irrigated by tanks is between 30 to 40 thousand acres. As, however, we have lately had years of scanty rainfall and some of the large works which have recently been made have not yet had a fair chance, it is hoped this area will be much increased. The Ramgarh Reservoir alone should add 10,000 acres.

15. *Q.* In paragraph 8 you say if all the tanks filled they should do 132,000 acres. Do you want a storage capacity of 4 or 5 times 120,000 cubic feet to irrigate an acre?—Yes; if you are depending on surface rainfall alone—by this I mean that, owing to the precarious nature of the rainfall, one's expectations are often not realized. It is very necessary to supplement the supply by tapping nullahs or rivers or by extensive cuts to increase drainage area wherever possible.

16. The duty must be calculated on the actual storage, not on the storage capacity.

Col. Jacob.

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17. *Q.* Sometimes a tank fills more than once or overflows? When a tank does fill do you get one acre for 120,000 cubic feet?—We ought to do so. I have not been able to check this sufficiently yet, but it is a very important point and one to which attention is directed. Every large tank is being contoured and the capacity at every foot in height is being registered, so that every year we shall be able to tell the area which ought to be irrigated and so check waste of water which is often great or find out the cause, as 120,000 cubic feet ought to be ample for an acre including losses by evaporation and leakage. (See last but one page of general statement of Irrigation Works submitted).

18. The Chaparwara Reservoir in a year when the tank filled irrigated about $\frac{7}{10}$ (seven-tenths) of the estimated quantity.

19. The height of the bund depends on the comparative cost of raising the bund and of making an escape. The delay of 25 years in construction of the Ramgarh Bund was chiefly due to a misconception on the part of the Bhartpur State—the next State lower down. There had always been some tension between the two States. The matter was subsequently settled by the Residents and engineers in a friendly way chiefly by the influence and interest shown in the matter by the Agent to the Governor General for Rajputana at the time (Sir R. Crosthwaite).

20. *Q.* Have any tanks water left in them at the end of the irrigating season?—Very seldom; tanks generally run dry; large ones in April and small ones after the first sowings; the margin and beds are then cultivated.

21. Whether water should be run off or kept till next year depends a good deal on the shape of the bed and the nature of the soil.

22. Water is only given when asked for and water-rate taken, on the understanding that cultivators may possibly get only one watering. Each village gets its watering in rotation. Everyone is free to take water or refuse it. Application is made for water; there is no compulsion, often without specifying area. The Zilladar of Abpashi (see paragraph 25, page 5 of printed memorandum for duties of the Abpashi establishment) controls the distribution and decides in what shares it should be given, judging from the amount of water available and previous experience. This and the measurement afterwards of the land irrigated, and general supervision of all irrigation matters with the villages are his duties.

23. The pay of the Ziliadar and his establishment is included in the total expenditure on irrigation (57 lakhs). This also includes the cost of all surveys—repairs to all tanks, also the cost of the works handed over to the Durbar (see paragraph 13, page 3 of printed memorandum)—also a few works which are made more as public improvements than for irrigation. The account is an Expenditure and Revenue account. The Engineers' pay is not charged against the works as they are employed on roads and buildings and other works also.

24. As regards figures of areas, revenue, etc., we have to depend on the return submitted by the Tahsildar or Raj officials.

25. The enforcement of "kiaries" has lately been abandoned (paragraph 27, page 6 of printed memorandum) as it led to much dispute and dissatisfaction, and gave opportunity for dishonesty.

26. The black cotton soil of Jaipur is much lighter than the black soil of Central India. I have had no experience of land in which water is not taken. I have heard that in the Kotah State water is not so eagerly sought after as not being so necessary in ordinary years, but I am unable to speak from personal experience if it is really so.

27. *To Mr. Ibbetson.*—I am unable to state the proportion of cultivated lands in the State to total area—but both kharif and rabi are considerable.

28. *To Mr. Higham.*—As a rule water from tanks is only given to rabi, unless it is expected that there will be water to spare. When rain holds off water is given for first sowings of rabi, and as many more waterings as possible; but sometimes there is not enough water for this even.

29. There is no doubt that tanks assist wells.

30. *To Mr. Ibbetson.*—I strongly advocate constructing tanks to hold all the water which it is possible to store, even up to two years' supply—if it can be done at a reasonable cost. I would, however, utilize all the water during the first year if there was the demand. To make a tank really protective it should be large enough to irrigate all the culturable area within reach twice over and leave a margin.

31. Most of the work of constructing tanks, as regards the earthwork at least, is suitable for famine labour.

32. *To Mr. Higham.*—In the Ramgarh dam the core wall consists of clay and sand mixed—its object is to prevent the body of the bund behind the core wall from being saturated with water—it will not stop all leakage, as it was not possible to take it down to an impermeable strata, and no doubt water will leak through from below—but this will drain off, at the ground level.

33. The head works of the canal for irrigation are situated on the river about a mile lower down and will catch all leakage.

34. The greatest depth impounded at present has been 47 feet; there was more leakage through the sand hills to the north of the bund than through the bund itself.

35. The toe of the outer slope is made of bajri, then small broken stone; and outside of all, large rubble stones; this allows any leakage to pass away without injury.

36. *Q. By Mr. Ibbetson.*—Is it safe to do this sort of work of making bunds with the amount of supervision possible in carrying out famine works?—I have found no difficulty where the soil is sand; and there are no clods; in such cases (of hard soil) there would be a danger of the earth not being properly consolidated unless very carefully supervised. Famine labour in such cases had better be confined to very small works—such as terracing fields or where a breach would not be of much consequence.

37. The water-rates are entirely apart from the land assessment. A man pays his water-rate and share of his produce (generally about one-third) and this goes to the credit of the tank; after deducting old cultivation no addition is made for increased outturn on old cultivation without the aid of the tank as far as I know. The figures quoted are those sent to us by the Durbar officials.

38. I am unable to state extent of area of old cultivation irrigated from tanks; the new is, I believe, much larger than the old.

39. Revenue is also paid on cultivation in tank beds; none from raising of the spring level in wells. No credit is given in the case of the 19 villages near Shigrai which have been protected from silt by the bund Madho Sagar at Gerowli (page 10, paragraph 36 of printed memorandum).

40. In one case, Tori Sagar, a small village was submerged by the construction of the reservoir. The Thakur's house and fort and fields, the whole village in fact, was submerged. The Durbar treated them very liberally; full compensation was paid to the Thakur and others; fresh land was allotted above high water level and a large new well made and a new village formed and additional land given below the reservoir. This liberal treatment has had an excellent effect in diminishing opposition to tank projects.

41. A large number of small private bunds have been made by Thakurs. The smaller cultivators sometimes terrace their fields, making small earthern banks round the lower end, called in these parts "nadas." It would be a good thing to help them in this work. The Durbar does always help them whenever the matter is represented. Whenever requests of this kind are made to us they are sent up to the local authorities and a surveyor or any other help is gladly given. There is great difficulty in getting the smaller men to co-operate for their joint interest; nothing in fact would be done at all in khalsa lands without State control. I do not think it would be fair to stop work which was first in the field, even though it was likely to interfere with contemplated State work, unless it was a large work calculated to cut off more than the share of the water to which the individual, by position on the drainage area, was fairly entitled to take.

42. Expert assistance is necessary to assist villagers in making small works and whenever it is asked for it is freely given.

43. There is no very large scope in the Jaipur State for making small bunds along nullahs; the country is not flat enough generally to admit of long bunds and inundation cuts as in the Bhartpur State.

44. *Q.* What works do you recommend for famine relief?—Chiefly earthwork of tanks, canal banks or roads, collection of kankar; if the sites are conveniently near; and in some cases breaking of ballast.

45. I should like to make a few remarks as to Rajputana generally:—

(1) The facts which strike one are—

(*a*) The great need of water.

(*b*) The necessity there is for storage reservoirs of some kind, owing to the precarious rainfall and the absence of large perennial rivers.

(*c*) That where water has been stored judiciously and economically it has always proved of great benefit and is appreciated by the people.

(*d*) That no attempt has been made as yet, to make use of some of the largest rivers in Rajputana. Every year these carry away an immense quantity of water, which is an *annual* loss to the country.

(*e*) The absence of all data as to whether it is possible to make use of the water.

(2) Hitherto all the efforts in the way of irrigation in Rajputana have been confined to individual States, and have often been taken up or carried out only because of the personal interest taken in the subject by the Engineer officer of the State.

(3) No attempt has been made to look at Rajputana as a whole from an *Imperial* standpoint and all the States of Rajputana as members of one large family, whose interests might be combined.

(4) What has probably hindered any consideration of this sort is perhaps—

(*a*) The difficulties which bristle round any question in which two or more States would be concerned.

(*b*) The want of funds, as most of the States have no money to spare.

(*c*) the absence of data which would enable any project to be brought forward.

(5) The paramount power by its advice or influence can alone remove the difficulties and perhaps provide some means to carry out a large work if it is found possible to bring forward any project.

(6) It may not be possible, after all, to find any suitable project, but until the country is properly investigated it is not possible to tell.

If it is found to be impossible from an engineering point of view it is of no use to take any further action.

(7) If, on the other hand, some good projects are found practicable it will then be time enough to tackle the difficulties which may surround it from a political or financial point of view. *Col. Jacob.*

(8) The first step is to get all the information possible and I do not think any other considerations should prevent this being obtained and obtained without delay, so as to stop if possible, this *annual* loss of water. 18 Nov. 01.

(9) It need not commit any State to any scheme or expenditure. It might be explained to all that the only object in view is their own welfare, the benefit to the States themselves. There ought, then, to be no difficulty in securing their co-operation, in this preliminary step at all events.

(10) If this suggestion meets approval, the next question is how it is to be carried out? It is not advisable to put an Engineer officer on high pay to take up each river or separate scheme, regardless of the heavy item of establishment charges.

A man should be appointed whose heart is in the work, a good European officer with perhaps one or two native assistants. He ought to be able then to supervise the work of a dozen native surveyors.

He should make a personal reconnaissance of every large river, taking one or more surveyors with him, finding out from local information and inspection what appears possible, giving instructions in writing on the spot to his surveyors and, in case of any surveys being made, arranging for permanent bench marks.

In this way in a few months a great deal of information and data would be acquired.

This should be compiled, printed if possible, and put on record in a systematic way, so as to be available at any time hereafter.

A great deal of money, time and labour has often been wasted from want of this being done.

(11) Under the circumstances, considering how much good might possibly accrue to the Empire as well as to the native States, I think it would be a wise policy if the Imperial Government bore all the initial cost of these investigations. If carried out economically, as suggested above, the whole cost would not be a large item.

(12) If any scheme is eventually carried out, the initial expenses incurred by the Imperial Government might be then recovered or be a first charge on the revenue derived.

Witness No. 2—Dewan Bahadur Balmukand Das.

1. *Q.* (*The President*).—You are a Member of Council in the Alwar State?—Yes.

2. *Q.* We have come to these States merely to see whether we can be of use in suggesting any improvements for protection against famine. We should be glad if we could do so. We wish also to learn something of the system of irrigation in Native States because very likely we may learn good lessons from it. We should be glad to get information from you as regards protection against famine in the state of Alwar—the State tanks and other works—and what you would do if another famine were to come. We have a statement from Mr. Macdonald in which he says 40 old tanks have been reconstructed. You have altogether 22 new tanks. Were these made last famine?—No, they were not all made during last famine—they were made during the last ten years.

3. *Q.* Is there room for the construction of more tanks in Alwar?—There are projects for 7 new works, but there is not much room for more.

4. *Q.* Have the tanks which have been restored and which are working proved profitable?—The works constructed have been more or less beneficial to the State by increasing irrigation, improving wells and fertilising beds of tanks.

5. *Q.* What percentage of the capital is obtained do you think?—In some cases they pay about 5 per cent., in others much less.

6. *Q.* And during the late bad times did they work well or were they all empty?—During the late famine only a few tanks got any water.

7. *Q.* Has the level of water in wells been affected by the tanks?—Yes, largely. The depth of water near tanks is 15 feet and where there are no tanks, 40 feet to 50 feet. In one tahsil 80 or 90 feet.

8. *Q.* To what depth will people use wells?—Up to 50 and 60 and even 70 feet; not more.

9. *Q.* Are new wells being made extensively? What does a well cost?—New wells are being made every year. A well would cost between Rs. 100 and 200. If all masonry, Rs. 400 to 500. *Dewan Bahadur Balmukand Das.*

10. *Q.* Are advances given upon interest?—No interest has been charged for advances for wells during the past 20 years. 18 Nov. 01.

11. *Q.* In how many years do you recover the money?—It takes 2 or 3 years to make a well and then we begin to recover and recover in 5 years or for masonry wells in 7 years.

12. *Q.* Is the land revenue enhanced?—No enhancement is made until the next settlement. No lease of exemption is given.

13. *Q.* Do the people make tanks themselves or does the State make them all?—The State makes them all.

14. *Q.* When land is irrigated from a tank is water-rate paid in addition to increased assessment?—Yes, water-rate is paid in addition to fixed revenue assessment. There are three classifications for assessment of land revenue on irrigated or flooded lands:—(1) *chahi*, (2) *nahri* (3) *dahri*; chahi and dahri lands pay fixed revenue rates as assessed at settlement. Nahri land is charged water-rate at Re.1 per bigha for each watering in a Khalsa village and Rs. 1-8 per bigha in a *jagir* or *muafi* village in addition to the fixed revenue assessment. A bigah is $\frac{5}{8}$th of an acre.

15. *Q.* (*Mr. Ibbetson*).—Do they get two waterings on some crops?—Some fields get 3 or 4 waterings, *kharif* generally gets 2 or 3. Wheat and barley 3 or 4.

16. *Q.* (*The President*).—In what state are the tanks just now?—Some are quite dry; a few tanks hold water all through the year.

17. *Q.* Have you any rivers in Alwar from which irrigation is done or tanks connected with streams so as to be filled again and again?—No; there are no rivers from which irrigation is possible, except the Ruparel. I have been instructed by the Durbar to bring the Ruparel scheme to the Commission's notice. Much land that could be irrigated from the river lies fallow or barren. If Alwar got

Dewan Bahadur Balmukand Das.

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its full share it could irrigate thirty or forty thousand acres.

18. Q. (*Mr. Ibbetson*).—How is the land revenue collected?—In cash.

19. Q. What is credited to the tanks?—Water-rate. Land revenue is not credited to tanks, but I have allowed for that in estimating profits. For *nahri* we charge water-rate. In calculating profits we take into account excess land revenue due to the tank. Similarly, we credit *dahri* with excess over *barani*.

20. Q. You say some of the 102 tanks constructed by the State do not pay?—Some tanks don't pay more than nominally even allowing for indirect revenue.

21. Q. Would it not be a good thing to charge double rates for land irrigable from a well if irrigated by a tank or to debar well land?—Yes. We do not debar well land from tank irrigation.

22. Q. (*The President*).—What is your cultivable area?—873,069 acres. *Chahi*—166,061. *Nahri* and *dehri*—76,941. *Barani*—630,067.

23. Q. (*Mr. Ibbetson*).—Should not the extension by the tank of the area irrigated from wells be considered in estimating the return from a proposed tank?—Yes, but it is not done.

24. Q. Is there a large area in Alwar where wells could be worked profitably?—Yes.

25. Q. When this is the case and takavi is given why are not wells made?—During the last 3 years 338 wells have been made. We advance as much as we can spare.

26. Q. How long has this activity been going on?—For the last 10 or 15 years they have been making wells extensively.

27. Q. What was the difficulty before?—Famines have brought home to the people the value of wells.

28. Q. You say you recover small sums in 5 years and a large sum in 7 years. You don't find this prevents people from taking takavi?—No. Before the beginning of the year a list is called for of takavi required for wells. The tahsildar is made responsible, he revises the list according to funds available and distributes the amount. There is no delay or difficulty in getting the money.

29. Q. When was the last revision of settlement started?—In 1895. The assessment was announced in 1898 and 1899.

30. Q. So that all wells built before 1898-1899 have been assessed *chahi*?—Yes.

31. Q. This did not prevent people from making wells;—No.

32. Q. Why don't the people make tanks for themselves?—The people cannot afford to make them.

33. Q. Do you give them takavi for that?—No.

34. Q. Supposing the people wanted to make a bund would you ask Mr. Macdonald to assist them?—Yes.

35. Q. Has it ever been done?—I cannot remember a case.

36. Q. Have you ever tried boring tools?—No, they would be too costly in the rocky subsoil.

37. Q. Seeing that the State get enhanced revenue would it not be worth while to incur the cost?—I don't think so? Government would be incurring responsibility for failures.

38. Q. Do the cultivators bank their fields to hold back water?—Yes, for the best crops near the villages.

Witness No. 3.—Mr. A. R. MacDonald.

Mr. MacDonald.

18 Nov. 01.

Witness put in the following documents:—

1. Statements of old existing works, Alwar State.
2. Statement of new works.
3. Statement of proposed works.
4. Correspondence and notes on the proposal to make a permanent dam on the Ruparel river. Correspondence relating to Preliminary Investigations for Famine Protective Works, Alwar State (printed below.)

No. 8648, dated Alwar, the 17th October 1901.

From—Major L. Impey, Political Agent, Alwar,

To—The Secretary to the Honourable the Agents to the Governor General in the Public Works Department, Rajputana and Central India.

With reference to the correspondence ending with your letter No. 3442-S., dated 23rd September 1901, from your office, I have the honour to submit copy of letter No. 340, dated 4th October 1901, with map and enclosures from the State Engineer, Alwar, furnishing as far as possible the information required regarding irrigation works in this State.

2. Mr. Macdonald has described the various drainage systems in detail and it only remains for me to add that his remarks on the possibilities of improving and strengthening certain of the existing works will be brought to the notice of the Council. The great disadvantage under which the State suffers is that the Durbar is at present debarred from making use of the works of the Ruparel, except by means of the Silverh tank and the somewhat futile earthen bund at ghat. The other small works shown in the map as lying in this area are of little practical value. Two are broken and not worth repairs and the rest hold no water after the rains. The eastern tahsils of Lachmangarh and Kathamber are most liable to suffer from bad seasons though the land itself is of good quality, and it seems very desirable that some scheme should be devised to protect this tract in years of scanty rainfall. On this subject I am addressing you in a separate communication.

3. Of the proposed new projects described in form 4 the tank at Sarmathoti (D1) was entered last year in the list of famine relief works, and will be undertaken this year, should the necessity arise. The Sivawas project (D2) has been definitely abandoned as after a long enquiry it was decided in consultation with the Settlement Commissioner that the tank would not pay and that the sandy deposit formed by the Sabi river in flood would probably damage the cultivated area. In the case of D 3 (the Bigota tank) it was considered that the work would not repay construction owing to the small area of land available for irrigation below the bund. The Piplai bund (D 4) has been commenced. The connected project at Dherora and Berkiri (D 5 and 6) are at present under the consideration of the Revenue authorities. Some protection is required for the land in the vicinity of those villages in years of scanty rainfall, and at present the water in the stream it is proposed to dam, runs to waste.

Similar remarks apply to the Baraitch project (D 7). A reply is expected shortly, and I believe the undertaking is likely to be sanctioned.

No. 340, dated the 4th October 1901.

From—The State Engineer, Alwar,

To—The Political Agent, Alwar.

I have the honour to reply to your letters Nos. 1585 and 2144, dated 4th May and 3rd July, respectively.

2. The number of irrigation tanks at present existing in the state of which, it is considered, mention can be made, is 103. Of these, 40 are old but in more or less serviceable condition and petty repairs only have been required to them from time to time.

Forty are old tanks which had failed, but which have been reconstructed and enlarged.

Twenty-two are new tanks.

3. A map, in duplicate is attached, on which the positions of above named tanks are shown, by small circles each containing distinctive figure and number.

Old tanks are numbered A to A—40.

Old tanks reconstructed B to B—40.

New tanks C to C—22.

Possible new schemes D to D—7.

On the map, also, the various drainage systems of the State have been defined in different colours and numbered from 1 to 23 in large figures.

4. With regard to the data asked for, I have carefully read the instructions laid down in the enclosures to your letters above referred to, and which I regret to state that I cannot comply with in the form required. As regards the old tanks I have nothing whatever to do with them except to execute petty repairs if asked to do so. There are no drawings or details to be found about their construction, and with them as with all other irrigation work in the State, the management of and distribution of the water is, out of my province. I can therefore only supply such information as I have been able to procure from the revenue authorities.

5. About how the tanks are worked or on what basis revenue is assessed, I offer no opinion as I have nothing to do with this work, but from my observation during the past 11 years, I have come to the conclusion that, in this State, the villagers clamour for old bunds to be repaired and new ones made, and when their wish is gratified will not, unless under great pressure, break up new grounds as long as they have wells to work. If the water is run off they will cultivate the beds of tanks and they will use the water run off, if it flows over cultivated grounds, but they trust to their wells for their means of livelihood and payment of their rent. If without trouble they get any help from the tank so much the better. If not, no matter. It thus follows that very many of the tanks are undeveloped, and the good they do is mainly indirect by sustaining the water level of the wells.

6. I have been unable to discover any minimum either of water received or land irrigated in seasons of drought for most of the tanks; as through the past seasons, although there has been insufficient rain to mature the crops, there seems to have been in every year at least one abnormal fall which has virtually filled the tanks. How the water has been used I cannot say, so I can only note results supplied to me by the revenue officials as to the area realized or area cultivated.

7. Attached will be found in four forms such information as I have been able to procure about existing tanks and new projects which may yet be developed.

8. As irrigation work in the Alwar State is from an engineering point of view very unsatisfactory, I am giving in the following paragraphs 9 to 16 some notes about physical and other difficulties encountered which may, although apparently irrelevant, throw some light in the matter.

9. About one-third of the total State area is hills or hilly ground. Here the ground slopes quickly from the hills to the streams which form in any valley and the streams themselves have steep beds. In the valleys wherever a tolerable flat stretch of ground occurs, this is almost invariably cultivated from wells. As the revenue from ground irrigated from wells far exceeds what would be derived from that irrigated from tanks, the construction of tanks except to fill the wells would mean loss of revenue.

10. Where plains exist between the hills the ground is extremely friable and the streams have deep-set and porous beds. About this sort of ground I cannot do better than quote remarks made by Mr. Joscelyn, Superintending Engineer, Rajputana and Central India, in a note after a tour of inspection in the State. His particular reference was to the big stream shown in drainage area No. D1. He wrote "We found the plains rising towards the hills and the light loamy soil giving place to compact undulating country deeply fissured with almost impassible ravines. Irrigation dams on any large scale are useless here as the configuration of the ground is unfavorable to storage basins, and the land is so high and broken up that water could not be brought over it. There is cultivation in the wider ravines or nallah beds which is irrigated by wells. It may be feasible and profitable to put up low bunds of dry stone across these nallahs at certain places so as to retain the water of freshets as long as possible and also to induce the deposit of silt to a wider extent upstream. I may say that the latter proposal was one made by me to Mr. Joscelyn as forlorn hope and one, at best, of very doubtful expediency."

11. On the eastern half of the State there is a considerable extent of plain. Here, however, irrigation work is, in places, absolutely debarred owing to water rights over the streams claimed by neighbouring States. For instance, the water of the principal stream in the State, the Ruparel, as well as of its tributaries, included in drainage area 15 is claimed by Bhartpur State although the streams owe their origin entirely to the Alwar State.

12. On other parts of the plain where tanks can be made, without question most of the available sites have been utilized. When such tanks have been formed and assessment has been made on them it virtually prevents the construction of other tanks on tributaries of the stream closed, as such new tanks would reduce the water supply into the old tanks and cause trouble. In this connection, as an example, I would refer to tanks A6 and A5 in drainage area 2. These are fairly profitable works and made first on the system of streams. Tanks B11 and C8 have been subsequently made but no further work can be constructed on these streams without harm to A 6 and thus to A 5.

13. Several of the first made works are, on the whole, fairly profitable for the simple reason that they are situated on the few sites where a reasonable spread of water was possible with a moderate dam. Alwar, however, is not a country for dams yielding good revenue.

14. The ground is too near the hills and the slope too steep. To obtain anything like a good spread of water, dams high and expensive in proportion to the revenue accruing have to be made, or where the average height is moderate, the portions across the streams are high and costly owing to the deep and porous beds of the streams and to the friable and unreliable nature of their banks.

15. Again, owing to the small spread of water obtainable and the size of dam required to obtain it, the cost of facing dams with masonry is generally found to be prohibitive, and in most cases if a dam has to be made at all, simple earth banks have to be relied upon where the nature of the soil really requires masonry to assist. Very many of the bunds are thus only kept in order by constant and naturally expensive repairs, which help to nullify the profits, especially as in many places where, as in drainage areas 2, 16 and 18, bunds have been made on the chain system, and the failure of a bund anywhere in the chain means the destruction of all lying below it.

16. Hardly a site remains where a tank can be made without either submerging well land or without well land lying between the dam and the ground which can be cultivated from the tank. Villagers, as is possibly natural, offer strong opposition to irrigation channels being cut through their well land even though land lying waste for want of water lies beyond it. This opposition has considerably delayed the development of many tanks.

17. The above remarks have been made to show the difficulties in irrigation extension in the State and also in some way to explain how little scope there is for future development. They may also throw some light on the reason of the apparently nominal *direct* revenue which perusal of the detail notes on the various bunds will show, is realized.

18. Out of the whole number of existing tanks in the State only three can be said to hold water from one year to the next. On all other tanks it seems to be an established rule that the sluices should be opened at the commencement of the cold weather and the water runs off as fast as possible so as to allow the tank bed to be cultivated. What is done with the water I am not in a position to state as the Engineering Department has nothing to do with this matter. The three tanks which at present hold up more water than is used, are—

(*a*) Siliserh A 13, on area 12 where a certain balance is always reserved.

(*b*) Malana C 18, on area 20, where sluice irrigation has been at present only partially developed, although this is only a question of time.

(*c*) Ajabgarh A 40, on area 21, a tank without an outlet.

19. The following paragraphs 19 to 40 give a few remarks about the 22 drainage areas shown on the map.

20. Area 1 shows the streams rising in the range of hills forming the north-eastern boundary of the State and flowing out of it. On these streams wherever practicable, tanks have been made with the exception of one site D, where with difficulty an expensive but moderately productive project is feasible. The ground in this area is extremely friable and untrustworthy. The average rainfall is about 23 inches.

21. Area 2 shows a system of a stream and its tributaries rising in the hills near the centre of the state and flowing north out of it. To works on the main stream reference has already been made in paragraph 9. Inspection of the map will show the doubtful efficacy of the system of bunds on a chain constructed elsewhere in this area.

22. No new site has been discovered where a tank can be made without cutting off water in part or whole from some existing work. The average rainfall is about 21 inches.

23. Area 4 is the drainage area of a considerable stream called the Hajipur or Hursora Nallah. There are no tanks on this area. Here and there at high cost and giving little or no direct revenue, small works might be made to close tributary nallahs but neither on these nor on the main stream, which has a steep slope and deep bed does there appear to be any site where a dam showing any promise of direct profit could be constructed. The average rainfall is about 21 inches.

24. Area 5 is a small strip of land lying near the Sabi River with nothing on it and no site for a bund. The average rainfall is about 20 inches.

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25. Area 6 is a plain of silty and sandy ground. It has only one bund on it where a stream running into the Sabi river has been closed at C 9. A big dam might be made across the Sabi river itself at D 2, and the project was worked up some years ago by order of the Agent to the Governor General for Rajputana. It apparently, however, did not show sufficiently promising results. There are no other streams on this area. Rain water falling on it is soaked up by the light soil and where any small nallahs form, they are intercepted by village *dhols* or ponds. The average rainfall is about 19 inches.

26. Area 7 is a small strip between the hills bounding area 6 on the west and the State border. A few streams with quick slopes cross it from the hills, but there is no practicable site on them for bunds. The average rainfall is about 20½ inches.

27. Area 8 is the drainage area of a stream called the Surakh Nallah. In old days a bund was made at B12. No other work could be constructed without interfering with this tank and reducing its value. The average rainfall is about 20 inches.

28. Area No. 9 is the drainage area of a small stream running into the Sabi. No site for a bund has been found on it. The slope of the ground to the stream and of the stream itself is too steep. The average rainfall is about 20 inches.

29. Area 10 is the drainage area of a considerable stream called the Narsinpur Nallah. Although the remarks made are equally applicable to a considerable portion of the State, the note by the Superintending Engineer quoted in paragraph 7, was specially written about this stream. One old bund has been enlarged and reconstructed at B13 on this area, but no other site has been discovered for a tank. The average rainfall is about 23 inches.

30. Area 11 is a small strip on the Jaipur border. There is one stream on it on which traces of an old broken bund are extant. Investigation shows that the site is impossible. The average rainfall is about 26 inches.

31. Area 12 is the catchment of the Sibsirh tank A13, the most important work in the State. No new works can be made on this area without reducing the efficiency of this tank. The average rainfall is about 27 inches.

32. Area 13 is the drainage area of the Chuhar Sidh Nallah and of its tributary the Soth Nallah. A number of nallahs receiving the drainage of a considerable hill area, collect into one stream called the Chuhar Sidh, which after running for some distance in a wide and deep channel discharges its water over the plain, the channel disappearing. Three bunds, near where the Soth Nallah joins the Chuhar Sidh, collect and distribute the water. Three bunds have been made on tributaries of the Chuhar Sidh, one some years ago, A19, another recently by order of the Agent to the Governor General at C10, and an insignificant one at C11, but no further works can be made without harming existing arrangements. On the Soth Nallah and its tributaries there are four old works of sorts. The average rainfall is about 24 inches.

33. Area 14 is the drainage area of the Lundola river. Five old established bunds on small tributaries exist, of which three have been repaired, but water-rights over the river are held by villages in British territory, so no dams to hold up the water can be made. Three works to divert the flow and cause the water to submerge tracts of flat country are in existence, one on the main stream B19, and two on tributaries B20 and C12. The average rainfall is about 22 inches.

34. Area 15 is the drainage area of the Ruparel, the principal stream of the State and its tributaries. Water-rights during the rains claimed by the Bhartpur State prevent this river or its tributaries being closed by bunds. The result to the Alwar State is deplorable, as a large tract of the best country in the State is debarred from irrigation, but until some readjustment of the treaties is made nothing can be done. There are thus only nine bunds on this area, of which seven are old established ones, and two modern ones on minor nallahs. The only way in which the Alwar State can attempt to benefit by the water of the Ruparel is, by temporary banks thrown across the streams to bank up the cold weather flow and divert it by canals to the plains in the neighbourhood. The only work of this kind worth mention is the canal which is marked on the map near B21. The bed of the canal at the stream is 12 feet higher than the bed of the river, and the water can only be led into the canal when it has banked up to this height. For some years owing to unfavourable rains, the cold weather flow of the river has kept diminishing until now there is little or no flow. The average rainfall is about 24 inches.

35. Area 16 shows the drainage of a considerable tract of loamy ground in the south-eastern corner of the State. There are no well defined streams, but numerous bunds have been made on the chain system along the course of the general flow of the drainage. The prosperity of the tanks depends on whether water is run from one tank to the other. If the villagers of the upper tanks are allowed to use up water on their fields the lower lying *tanks get no water but that of local rainfall. There* are no sites in this area for new tanks, in fact a great many more tanks seem to have been made than fill. The average rainfall is about 17 inches.

36. Area 17 is a strip of ground with only one defined stream. This has been intercepted by a bund at B30. All rainfall soaks into the ground or is intercepted by village dhols. The average rainfall is about 18 inches.

37. Area 18 is the drainage area of the Rohera Nallah. This stream rises and flows for some distance in the Alwar State. It then crosses a strip of Jaipur, when it re-enters Alwar. On the first portion are three bunds. On the second portion are five bunds. The efficiency of the latter has been latterly much reduced by works in the strip of Jaipur territory where a good deal of water has been diverted. There are no sites left for new works. The average rainfall is about 20 inches.

38. Area 19 is a small tract of ground on the State south border. Three bunds exist, and there is a site for a fourth at D3. The average rainfall is about 25 inches.

39. Area 20 is the drainage area of two streams known as the Bhagani and Bhagari Nallahs, which eventually combine. The former is closed by a new bund at C17, and there is a small old work on one of its tributaries at A39. The latter is closed by a big dam at C18 and there are four bunds on tributaries. Below the junction of the two streams there are two bunds on tributaries. There are no sites left on this area. The average rainfall is about 26 inches.

40. Area 21 is the drainage area of the Ajabgarh Nallah. The principal tributary is closed by a bund at C21. It has an old bund at A40, and there is also a site for a new work (recently sanctioned) at D4 higher up on the catchment. On the main stream a fairly large work is in progress at C20, and higher up on the catchment an old bund has been reconstructed at B40. No new works can be made above C20 without reducing its efficiency, but there are no sites owing to steepness of the ground and to well cultivation. Below C20 there is a small work, at present out of repair. at C 22; and a big earthen dam could be made at D6 and filled by closing the river at D5 and cutting a canal across. This project has been submitted, as the canal would pass entirely through well land there and the whole seems too costly, it is yet under consideration. The average rainfall is about 26 inches.

41. Area 22 is the drainage area of the Partabgarh Nallah. There are several old broken bunds in this area, but investigation shows them to be not worth repair. Only one site has been found for a storage tank at D 7. All through this area the ground falls exceedingly quickly from the hills to the streams and the streams have deep and steep beds, and whenever there is any flat ground it is cultivated from wells. The average rainfall is about 26 inches.

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1. *Q.* (*The President*).—You are the State Engineer of Alwar?—Yes.

2. *Q.* I suppose you have all the works under you?—Yes, except little petty things.

3. *Q.* I suppose the irrigation works don't occupy all your time—you have plenty of other works?—Yes.

The President.—The Governor General's Agent has alluded to an old dispute between Alwar and Bhartpur, but I do not think that it is any part of our business to be judges *between two States and hear the evidence of the two sides.* In my opinion, the utmost we could do would be to call attention to the dispute and point out that a dispute like this was not for the public good and we might express a hope that the question might be settled one way or the other.

4. *Q.* Are any irrigation works being constructed in Alwar?—For the past two years hardly any irrigation works have been constructed. All the works were made before

that. Two dams, one fairly large, are now in hand. The ground slope is very steep and you get very little direct result for the money. In open country all the goods sites have been taken up. In the hills nearly all fairly level ground is already cultivated from wells which yields higher revenue than tank flooded land. In the matter of the dispute between Alwar and Bhartpur, if Alwar could build a dam, across the Ruparel, with a weir which could be adjusted to the height of the banked up, cold weather flow, below canal bed level, so as to prevent the loss of this water when the temporary dam is cut, I think they would be satisfied.

5. *Q.* Do you keep up a programme of famine works?—Yes, on our famine works programme we have at present about a dozen *kachcha* roads and tanks which would otherwise be considered not profitable.

6. *Q.* Was much work done last famine?—Yes, a good deal. Whatever was started is being finished.

7. *Q.* It has been suggested to us that something could really be done for Rajputana irrigation if the States could combine. Is there anything in which Alwar could combine with the other States?—I know of no scheme in which Alwar could combine with the other States.

8. *Q.* (*Mr. Higham*).—With regard to the Ruparel scheme I don't quite understand. Alwar gets no water now till the 15th October?—Alwar gets no water in flood season, we have to cut the bund on 15th June and are not allowed to remake it till 15th October. I am not sure about these dates. The bed of our channel is 12 feet above the bed of the river. We get in the cold weather, at present, owing to failure of cold weather flow, in the last few years, a flow of only about 9 inches deep and 4 feet wide. The water takes so long to rise in the river bed, to canal bed level, if it does reach that level, that, by the time it begins to flow, the season for utilizing it is over. *Mr. MoDonald.* 18 Nov. 01.

9. *Q.* Have you ever considered which would be the best, to make a weir or deepen your existing channel?—With a weir we would get the water on to the surface nearer than with a deepened channel. To deepen the channel would cost about Rs. 1,00,000 and we should not get on to the surface for 8 or 9 miles. It would also interfere with existing assessment. Villages which now have claim on the water would not get it as it would pass beyond their land.

10. *Q.* Practically you get nothing, only 9 inches depth of water. What is the good of your bund?—Nothing at present, but they won't give over making it. What I understand we want is to keep the water we have got banked up in the river channel at the commencement of the rains which we now lose by the bund being cut. If we had the water at that level at the end of the rains we should gain all the time now required to make our bunds and for the river channel to fill up again to canal bed level. (Witness also said that the spring level had fallen greatly. In his compound it had gone down 40 feet in the last seven years and he had had to deepen many of the State wells 10 to 20 feet)

WITNESS No. 4.—MR. J. A. DEVENISH, State Engineer, Bhartpur.

Witness put in the following documents :—

1. Record of Irrigation by bunds and channels in the Bhartpur State during the years of 1895—1900.

A note on shallow reservoirs, etc. (printed below.)

Note by witness on the use in Bharatpur of shallow reservoirs for temporary storage of flood water.

In flat country where sites for deep reservoirs are not obtainable, water may be stored temporarily for irrigation by the use of shallow basins formed by low banks built across wide drainage depressions. The drainage of these depressions and floods diverted from other catchment areas, discharge into the basins (locally termed "bunds") and are impounded in them to the full capacity of each, the surplus quantity received being allowed to escape by sluices, or by byewashes into subsidiary basins; or, if these latter are not available, the escaped water can be diverted to saturate the neighbouring land where required.

2. In a typical case supposing that the longitudinal slope of the bed of a drainage depression averages 8 feet in a mile and that the width of it across is one mile, a bank one mile long, stretching across the dip and sufficiently high to retain an eight feet depth of water, is capable of submerging about half a square mile of country in front of it, and the basin, if it can be filled, is capable of retaining about 100 million cubic feet of water, more or less, according to its contour. With a rainfall of 30 inches between five and ten square miles of catchment area would be required to shed enough water to fill it. Such a basin is by no means adapted to the prolonged storage of water, but under favourable conditions of climate and soil it may be of great benefit to agriculture when used for the temporary storage and distribution of floods. The loss of depth of retained water due to evaporation and percolation and absorption in the basin is not less than 8 feet per annum; and it is economical to empty the basin as soon as possible by means of sluices in order to flood land in rear. If the floods have been late and if the supply is ample the basins may be nearly full at the end of the rainy season when the time comes to prepare the ground for the winter crop; if there have been no late floods the basin may be nearly empty at that time. As soon as the ground surface of the bed becomes dry, either by natural exhaustion of the reservoir or by the emptying of its contents through sluice openings, the land that has been submerged in front of the bank will be found to be thoroughly saturated, softened, and fertilized so that it is at once ready for the plough. The land that has been flooded in rear of the bank by means of sluices and distributary channels will also be softened for the plough and saturated sufficiently for the sowing of the *rabi*. It is important to note that the land in the bed of the tank or basin is by far more valuable than that in rear, because not only has the subsoil of the former been saturated, to which the roots of the crop penetrate, but also a layer of fine silt has been deposited on the surface; whereas the irrigation in rear does not saturate the subsoil or deposit much silt. *Mr. J. A. Devenish.* 18 Nov. 01.

3 The crop sown in the bed of the tank is independent of subsequent watering in order to reach maturity. Moderate rain, indeed, assists the growth and increases the yield, and in years when the winter rains fail the growing crop is in some places watered from wells. Without such aid, however, it will remain healthy, deriving its nourishment from the moisture retained in the subsoil. The crop sown in the rear of the bank depends partly on a subsequent refreshment by winter rain or from wells, failing such assistance its yield is small.

4. The system of shallow reservoirs here described is suitable not only for the impounding of small local catchments but also for the distribution of floods from large streams which may be diverted or led into the basins by means of feeder channels. If the latter source of supply be available sluices are used to carry off the excess supply above the capacity of the reservoir, distributary channels from the sluices discharging into other basins or saturating the fields in rear. Under suitable conditions the main advantages of this system of shallow basins compared with deep storage reservoirs are—

(1) They are far more remunerative. The cost of construction is very much less. For low pressures of water earthen banks of slight section are sufficient. The use of masonry works is reduced to a minimum. The work is easy to design and construct.

(2) Dealing with low pressures the risk of damage is much less and damage is easily repairable if it occurs.

(3) A much greater area of crop is obtained in proportion to the supply of water, owing to the comparatively wide water-spread, in proportion to the cubic capacity.

(4) The bed of the tank is fully utilized for agriculture and becomes a much valued asset of the village, instead of compensation being paid for the loss of the land to the villagers.

(5) So much water is not exhausted unproductively by evaporation and absorption during prolonged storage as in deep reservoirs.

(6) The larger part of the crop is more valuable owing to the fully cultivated bed being fertilized by silt, whereas in deep reservoirs bed cultivation is usually discouraged and the silt deposit is consequently wasted. Crops irrigated by ducts during growth do not attain the yield of the bed crops. Even in years when the bed is not flooded it is cultivated, the enrichment of the soil being permanent.

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1. Q. (*The President.*)—You are State Engineer, Bhartpur?—Yes.

2. Q. Yours is not a State in which there are many storage tanks. I understand that there is only one such tank?—Yes, we have only one large storage tank. (In speaking of "storage tanks" the witness meant tanks adapted for prolonged storage—or storage after the sowing of the winter crop. Some of the Bhartpur bunds or tanks have shallow basins of large capacity, but the water is either exhausted naturally or let out purposely before the end of October. The storage is thus only temporary.)

3. Q. The configuration of the country prevents storage?—Yes, there is no need for it. We have got irrigation facilities without storage.

4. Q. What are the irrigated and the culturable areas of the State?—There were 82,000 acres irrigated last year from bunds or channels out of 767,000 acres of cultivated land in the State. 130,000 acres are assessed as irrigated by wells.

5. Q. (*Mr. Ibbetson.*)—The settlement report says 106,000 acres irrigated by wells.—Probably this means irrigated in one year.

6. Q. (*The President.*)—Were you in Bhartpur during the famine?—Yes, during the last two famines.

7. Q. What did irrigation do for you then?—It gave us a very fair area of irrigated crop. In 1899 we irrigated nearly 20,000 acres with the Ruparel water instead of the usual 30,000 acres and 53,000 acres in the whole State. The wells generally were not exhausted.

8. Q. How long do the cuts from the Bangangi run?—Generally for 2, 3 or 4 days at a time as long as the floods last, which fluctuate with the rainfall. In a good year with recurring floods the cuts may run for a month continuously.

9. Q. Your tanks are now dry?—Yes. The water is used mainly for the sowing of the *rabi*. There is some irrigation below the bunds in addition to the land saturated in front. The amount remaining stored after the *rabi* sowing is very small. The great thing is to saturate the soil for the *rabi*, which is afterwards helped by the winter rains. Rain is not essential to the maturing of the crop. Where there are wells the crop may be additionally assisted. The principal feature of our irrigation is that the land is flat; the fall being not more than 5 feet in a mile, so a very low bund floods a large area.

10. Q. Have you any black cotton soil?—No.

11. Q. What height are your bunds?—About 12 feet. They are long and low following a contour. They are old works. They are supplied with sluices.

12. Q. Who maintains them?—They are repaired by the State.

13. Q. There is no *corvee*?—No.

14. Q. Could your rivers be bunded with advantage and used as reservoirs?—No, there is no suitable site. We can irrigate without this.

15. Q. (*Mr. Ibbetson.*)—You say that there is no need for storing water because you can irrigate without it. Supposing you did store water, would you not get a much larger area?—No, it would not suit us at all. The most valuable land is above the bunds. The greater part of the water received is stored temporarily. For instance, one tank, the Bareta, is filled annually with 1,200 million cubic feet, the maximum depth being 8 feet, and the frontal water spread 14 sq. miles. By retaining the water in store after October the State would lose all the submerged land and would lose, moreover, the irrigation of a part of the large area in rear now flooded by the sluices before the *rabi* sowing, because gradual irrigation from store during the growth of the crop would not cover nearly so large an area as a rapid flooding. The full capacity of the latter is 1,500 million cubic feet and 250 million cubic feet are below the lowest sluice level.

16. Q. Is there any room for small works made by the people themselves?—The people have not the enterprise for it.

17. Q. You don't think they could be got to do it?—No. They are accustomed to the State doing everything for them.

18. Q. (*Mr Higham.*)—The bunds really form distributing basins, not storage tanks?—Yes.

19. Q. You state that by the Sikri Bund you catch the whole supply and redistribute it—what is the effect on the *nala* below?—There is very little trace of a *nala*.

20. Q. Don't you ever get a big flood you cannot dispose of?—No. We have only once had one really large flood in my time and our sluices were sufficient to prevent a breach. Escaped water flows over the fields and is caught by subsidiary bunds.

21. Q. (When you speak of the capital cost of your works, I suppose you mean the whole expenditure incurred, including annual repairs and everything except catchment?—Yes.

23. Q. How is the revenue derived?—Is it fluctuating. Does it depend on the area actually cropped?—The revenue from bunds is mainly included in the settlement. The assessment is generally fixed, not fluctuating.

23. Q. Then what do you credit the works with?—There are no accounts to show the profits due to irrigation works. But I can show the assessments before and those after the construction of the works. The difference is mainly due to irrigation. The settlement officer considers that the increase in the revenue is about 5 lakhs of rupees.

24. Q. Do you charge water-rate?—Water-rate is charged on new works, where the land has not been assessed as irrigated or where the irrigation is fluctuating. The water rate is Rs. 2-8 an acre.

25. Q. These figures show what you call capital cost has been at the rate of Rs. 12 per acre annually irrigated. Is that all it costs you?—That does not include the establishment for one thing. The total expenditure during the last six years on the works, excluding establishment; is about Rs. 12 an acre annually irrigated. This does not include cost of abandoned works subsequently restored.

26. Q. This irrigation is remarkably cheap?—Yes, it is.

(Witness shows statement of Bareta Bund and explains that cultivation from the tank has not been fully developed. Three hundred million cubic feet are below the sluice level. There is no land below this, and leaving this part does away with need for refilling at commencement of next year's flood).

27. Q. (*Mr. Ibbetson.*)—You say that the profit is equal to the amount of revenue now got *minus* the revenue before the works were made. I don't quite understand about the works being made. I thought they were all old works. When were they restored?—Within the last six years. In addition to these old works there are a number of new works principally inundation canals, to which more than a third of the irrigated area is due.

28. Q. You mean practically revenue before that restoration a few years ago?—Yes.

(Witness informed the Commission that with reference to the Ruparel scheme there would be no objection to Alwar using the whole cold weather supply as proposed by Mr. MacDonald.)

WITNESS No. 5.—MIR MOHAMMUD HOSSEIN, Deputy Collector, Bhartpur.

Mir Mohamsud. Hossein

18 Nov. 01.

In reply to *Mr Ibbetson*, witness said—I have been employed in the Bhartpur State during the past seven years. 145,652 acres are assessed as irrigated from bunds. A water-rate is assessed on all dry lands which are irrigated. The State has imposed a charge of Re.1 per bigha within and 8 annas per bigha outside the bunds for all new land irrigated. On the Bareta bund the charges are according to the crop, *viz.*, sugarcane Rs. 2-8-0; *makka* and rice, cotton and zira Rs. 2; juar Re.1; opium Rs. 2-8-0; wheat and barley Rs. 2; *bejhar* Rs. 1-8-0; and gram Re.1 per bigha. A bigha is $\frac{2}{5}$ of an acre. I have not calculated the profits on the Bareta Bund, but I think that the whole cost will be recovered in 15 years. There is no doubt about the profit from irrigation works. They have raised the land revenue of the State during the past six years by 2½ lakhs; besides giving Rs. 40,000 in annual water rate. It is calculated for one year, but will vary from year to year according to the area irrigated. In shallow wells the water is sweet; deeper down it becomes bitter. *Kachcha* wells are therefore preferred to masonry wells. Rs. 98,017 were given as takavi in the 8 years before the settlement of the land revenue; and in the two years succeeding the settlement, about one lakh. If a well is made even a year before the settlement, the land is assessed wet; but the fact that a well is new is considered

in distributing the amount of the settlement (*tafriq*). If a well falls down altogether the assessment is taken off in a new *tafriq* made every five years owing to the change in irrigated condition of land. Sometimes the Zamindars stop the working of their wells just before the settlement, but the area has been assessed as chahi during the settlement.

2. Previously takavi was given through the lambardars. Now it is given direct to the cultivator. Takavi is taken readily in Bhartpur. Recovery is postponed for two years and is then made in three years; no interest is charged.

3. The *ryasat* year begins in September; formerly it was in April. The water of the wells is brackish; but when the floods come the spring level rises and the rabi is sown, germinates and is ready for irrigation from the brackish wells. The floods do not sweeten the wells much; the bitter water of the wells causes *reh* which is washed away by the floods. There are in all 11,494 masonry wells in the State; of these 6,823 yield sweet water. There are besides 6,665 *kacheha* wells, of which about 2,000 are not worked. There are plenty of places for new wells, but the people are afraid of the bitter water.

Mohamud Hossein.

18 Nov. 01.

TENTH DAY.

Jaipur, 19th November, 1901.

WITNESS No. 6.—RAI BAHADUR SHYAM SUNDER LAL, *Dewan of Kishengarh.*

Witness put in the following documents:—

1. Preliminary investigation report, Famine Protective Works (printed below).

2. Statement of existing Famine Protective Works, Kishengarh State.

3. Statement of proposed works, Kishengarh State.

No. 623, dated 6th October 1901.

From—The Secretary, Durbar, Kishengarh,

To—The Resident at Jaipur.

With reference to his Memorandum No. 1997, dated 7th May 1901, and in continuation of Durbar Memorandum No. 596 on the subject of the investigation of irrigation projects for protective purposes, the undersigned has the honour to submit the accompanying returns of the existing and proposed Irrigation Works in prescribed forms with appendices giving the plans and estimates of proposed works.

2. A tracing of the map of the State showing the situation of the various existing and proposed irrigation works has been appended.

3. To the returns above referred to, there has been a general report marked E giving various particulars showing the economic condition of the Kishengarh territory and the directions in which further protection can be secured, whether by means of local conservation of water or by supply cuts from rivers outside the State (*e g.*, from the Khari river).

4. It is earnestly hoped that he will be good enough to take early steps for the submission of the necessary information to the Honourable the Agent to the Governor General in view of the same being laid before the Commission of Irrigation experts.

KISHENGARH STATE.

General Report.

The Kishengarh territory consists of a narrow strip of land 82 miles long extending from the southern banks of the Sambhar Lake in the north to the Khari river within a few miles of Deoli in the south. The breadth of the State from west to east varies from 20 miles in the central portion to from 7 to 10 miles at its ends.

The territory is situated between north Latitude 26° 17' and 26° 59' and E. Long. 74° 43' and 75° 13'.

The northern portion is partially sandy owing to the drifts of sand from the adjoining Marwar district in the west. The central portion has poor soil overlying stratified rocks in the north and gneiss in the southern half.

The southern portion has good rich soil which partakes of the nature of the Harowti soil overlying gneiss.

The State is crossed by rivers which enter it from the west side and generally take an easterly course inclining a little to the north (and falling into the Sambhar Lake) in the northern part (Rupnagar district) and to the south in the central and southern portions eventually falling into the tributaries of the Banas.

The State is bounded on the north by the Sambhar Lake, on the west by the Jodhpur State and Ajmer and on the south by Shahpura (Udaipur) and on the east by Jaipur and Ajmer.

The rivers don't run all the year round. In fact they are mere nallahs that are for a few hours in flood whenever there is a good shower of rain, and flow off and on during the monsoon season.

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(*a*) The total area of the State is 858 square miles.

(*b*) The population of the State according to the census of 1891 was 125,000 persons and according to the last census it was only 91,000. It may, however, now be safely taken at 115,000 persons owing to the return home of the emigrants.

(*c*) The total number of villages in the state is 231; of which 65 are Khalsa or Crown land and 166 are alienated or Jagir.

(*d*) The average land revenue of the State is Rs. 2,05,000.

In ordinary years it is Rs. 2,75,000.
In famine year 1899 1900 it was Rs. 58,000 only.

(*e*) The average area cultivated irrigated both in kharif and rabi by existing tanks is 42,000 bighas, by the bigger tank 12,000 bighas, by small *kachcha* tanks 54,000 bighas=21,600 acres—

1 hath=2 ft.
1 bigha=66 haths square.
$=\frac{4}{10}$ of an acre.
1 bigha=$\frac{2}{5}$ acre.

Area irrigated by wells—

=65,000 bighas.
=26,000 acres.

Out of the above nearly a third of (1) and $\frac{1}{5}$ of (2) represents cotton and other non-food grain crops, the rest being food grain crops.

(*f*) The average annual food grain produce of the State is 900,000 maunds, of which about 8 lakh maunds is required for local consumption taking it at 7 maunds per head.

(*g*) The approximate number of persons for whom work has to be found for relief in famine is 10,000. The proposed works would employ 21,000 persons daily for 3 months; of these proposed works, four are situated within the catchment area of the Sambhar Lake, *i.e.*, in the Rupnagar district.

(*h*) The average rainfall for the eight years preceding the last famine year is 20 inches as given on the margin.

Years.	Inches.
1891-1892	7·63
1892-1893	36 33
1893-1894	32 39
1894-1895	21 49
1895-1896	10·45
1896-1897	15·10
1897-1898	19 40
1898-1899	8 32
1899-1900	4·58
1900-1901	21·98

That for the famine year 1899-1900 was 4·58 inches only. The rainfall for 1900-1901 was 21·98 inches.

(*i*) The district has suffered from four severe famines and three years of scarcity during the last 32 years. But the last eight years with the solitary exception of the year 1891 have been years of short rainfall and poor harvests.

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(*k*) The total number of tanks is 165, of which 112 have catchment up to 2 square miles, 37 have catchment of 2 to 5 square miles, 16 from 5 to 10 square miles and four above 10 square miles.

There are besides over 1,000 small *kachcha* (earthwork) bunds or storage tanks which have each a catchment of less than half a square mile generally owned by cultivators.

The total catchment areas, the run off of which is thus secured for storage is over 500 square miles.

(*l*) The total number of wells including Jagir and Khalsa in the State is 10,573, of which over two-thirds are in constant use while the remaining third have fallen into disuse principally on account of the failure of supply of water in them during the last few years of successive deficiency of rainfall and also to a certain extent, on account of the water in them being hard and surcharged with sulphate of sodium, which renders the soil unfit for unintercepted cultivation.

The number of wells in each district is as follows:—

District.	Wells in use.	Wells out of use.	Total number of wells.	Food grain, total produce.			Irrigated area per well, and average in acres.
				Kharif.	Rabi.	Total maunds.	
(1) Kishengarh	1,387	872	2,259	20,000	98,000	118,000	3
(2) Rupnagar	1,047	783	1,830	24,000	124,000	148,000	7
(3) Sarwar	1,234	616	1,850	25,000	111,000	136,000	3½
(4) Arnia	1,299	839	2,138	26,000	91,000	117,000	3
(5) Bandersendri	535	376	911	12,000	39,000	51,000	3½
(6) Thikanas (bigger nobles estates) .	1,100	483	1,583	20,000	88,000	108,000	4
TOTAL	6,602	3,969	10,571	127,000	551,000	678,000	in normal years.

The area irrigated from the wells—

(*a*) in normal years is 26,000 acres.

(*b*) in the famine year is 9,000 acres, *i. e.*, a third of the normal area due to failure of water in wells.

(*m*) The northern portion that is the Rāpnagar district which falls within the catchment of the Sambhar Lake, used to have the best and most plentiful supply of water in wells and consequently the average acreage per well in the district used to be 12 acres, which is double or triple the area per well in other parts.

Thus it was in this district, unlike all the rest that storage tanks were the least needed on account of the successive failure of rains and the bunding of rivers higher up at different places, the wells have been failing thereby, pointing to the bunding of rivers within local limits, as the only means of restoring percolation in wells.

In the other portions, it will be seen that from time to time no effort has been spared in storing the rainfall over the Kishengarh territory, as would appear from the series of dams and weirs that have been constructed across almost every stream or nallah from place to place in its course. The total catchment area thus secured for artificial irrigation or protective purposes is two-thirds of the total area of the State and is made up as follows:—

358 Square miles for bigger irrigation works.

200 Square miles for the thousand and odd smaller *kachcha* storage works.

Total .. 558

The proposed new works are now calculated to add 115 square miles to the catchment area already secured for irrigation (both direct and indirect) which would thus go to make a total of 673 square miles, against 858 square miles, the total area of the State. A copy of the Kishengarh map showing all the irrigation works is appended.

General remarks.

The proposed storage works as well as those already in existence are of great use in ordinary years; but they fail in years of drought or scanty rainfall (when they would be the most needed) as the sources of their supply are mere rainy season nallahs or surface drainage and not perennial streams. The bigger rivers like the Khari, the Banas, the Chambal would appear to be free from this objection, but as conservation of their flood water or ordinary flow would entail interstatal difficulties and necessitate combined action both as regards the selection and carrying out of schemes and raising the necessary capital. The Kishengarh Durbar would be happy to join any such scheme. The Durbar would for instance be happy to join a scheme for diverting a portion of the flow of the Khari river, by means of cuts which has been suggested among proposed works.

1. Q. (*The President.*)—You are Dowan of Kishengarh?—Yes, I have been so for 16 years.

2. Q. You were a member of the last Famine Commission and can talk from experience of other places besides your own State?—Yes.

3. Q. You say there have been bad times in your State for a number of years?—Yes.

4. Q. The southern part of the State is the richest?—Yes.

5. Q. You say you have 22,000 acres irrigated from tanks and 26,000 from wells?—Yes.

6. Q. There is a large quantity of cotton grown?—Yes.

7. Q. Did the State suffer much during the last famine?—Yes, very much; out of a population of 125,000 as many as 16,000 were on relief works; about one-fourth of the people emigrated, but they are now returning.

8. Q. Have any objections been raised to your works on account of interference with the Sambhar Lake?—Yes, all the important works on our list have been objected to on this account. The State is a narrow strip running from north to south and all the rivers run from east to west, so that we can practically do nothing in the way of irrigation without questions being raised by other States; and works constructed to the west interfere with our supply. We want to hold up water chiefly with the object of restoring wells by percolation, but also for direct irrigation. There are very fine wells in the State.

9. Q. How deep are the wells?—About 60′ now, 40 to 50′ formerly; 60′ is not considered a great depth for wells. We use them for irrigation up to 90′.

10. Q. What crops do they irrigate?—*Makka* and cotton in the *kharif*. Wheat, barley, and carraway-seed in the *rabi*. The loss of percolation water owing to the construction of

bunds by Ajmer has lowered the depth of water in the wells in Rupnagar from 42' to 60'. This has reduced the average irrigation per well from 12 to 7 acres. It seems hard that we also should not be allowed to make dams; without them we can do nothing.

11. Q. Are there many small tanks?—Yes, a large number. They irrigate from 5 to 20 or 30 acres each.

12. Q. Are advances given for wells?—Yes.

13. Q. Are they availed of to a large extent?—No. There are two systems of encouraging well construction; *viz.*, takavi and concessions of revenue demand. For new wells we take $\frac{1}{10}$ of the produce during the first year, $\frac{1}{5}$ in the second year and so on until we come down to the usual $\frac{1}{3}$rd; we find this is a sufficient inducement.

14. Q. What is the cost of a well?—It differs. In Rupnagar it is about Rs. 300. In the central and southern portions it is much greater.

15. Q. Do you charge interest for the advance?—We charge 6 per cent. to cover failures which are numerous especially in the trap.

16. Q. Is the water ever salt?—The water is not salt, but it is sometimes very hard and useless for irrigation.

17. Q. (*Mr. Ibbetson.*)—You remit the whole in that case?—We remit the whole and cover the loss from the interest derived from other wells; we find that a great encouragement.

18. Q. Have you ever employed professional well-borers?—Yes. Borers serve a very good purpose up to a certain depth. They use tools made in the country.

19. Q. Do they belong to the Durbar?—Yes.

20. Q. Why are they not used beyond a certain depth?—Because the tools are not very skilfully made.

21. Q. It is the fault of the tools?—Yes.

22. Q. Would a zamindar who wished to make a well get a boring taken first?—No, boring commences when a well has been sunk to tap the spring.

23. Q. You don't bore first to ascertain the quality of the water and its depth?—No, I have been thinking of doing so. We always promise to refund the cost in case of a failure.

24. Q. (*The President.*)—Is the practice in force of putting bunds round the fields in order to retain the water and let it soak in for the *rabi* sowing?—Bunds are only made round the more valuable fields where water is scanty. By this means grain is sown even if there is very little rainfall.

25. Q. Has the Khari project been thoroughly examined?—Not yet. It should be taken up jointly by the three States concerned, with Government aid.

26. Q. (*Mr. Higham.*)—What is the fall in the water-level of wells in the Rupnagar district?—10' to 12'. The fall has not been quite as much in other tracts. It is due partly to the construction of the Kair tank in Ajmer and the construction of other bunds both in Ajmer and our own State; there are many small bunds and some large ones all along the streams in our own State as well as in Ajmer, and these have lessened the water. The fall has been going on for eight years. With a good rainfall there was no effect. The rainfall has been deficient for the past 14 years except in 1892, but this is not the only cause of the fall in spring-level. The bund at Kair in Ajmer cuts off all the water and there is no flow below it. What we want to do is to make a bund at Singla in the Rupnagar Valley to collect the local rainfall so as to assist our wells by percolation.

27. Q. There are you say a large number of *kachcha* works made by private individuals?—Yes, over 1,200 small works of this kind.

28. Q. Is there any room for extending them?—We have already utilized about $\frac{2}{3}$ of our available catchment in this way. They cost Rs. 200 to Rs. 2,000. The State gives concessions and takavi if asked for. The takavi is sometimes replaced by guaranteed loans, the lender having a first lien on the property. Our tank-irrigated area is far greater than our dry-cultivation area.

29. Q. (*Mr. Rajaratna Mdlr.*)—You say remissions are granted when the wells fail. What remissions have been given in the past 10 years?—I cannot say how much has been remitted for failure of wells—but the failures amount to 4 or 5 per cent.

30. Q. How much has been given out as takavi?—In the year before last we gave out Rs. 37,000 takavi for sinking and deepening of wells. Last year the rainfall was good and demand for takavi small; this year we will give Rs. 35,000. I cannot give the figures for the last 10 years but the average is about Rs. 20,000 a year; that is besides the guaranteed loans. *Rai Bahadur Shyam Sunder Lal.* 19 Nov. 01.

31. Q. You mention Agricultural Companies—what are they?—Companies who advance money for agricultural works and take $\frac{1}{4}$ or $\frac{1}{3}$ of the revenue in lieu of interest until the advance is paid. This amounts to much more than 6 per cent. This system is chiefly adopted in *jagir* villages held by a number of petty *jagirdars*. *Jagir* forms about two-thirds of the State. The State guarantees the payment of a moiety of the revenue in lieu of interest. The Company is subsidised by the State for further improvements. For large works we advance to *jagirs* at 6 per cent.

32. Q. Have the objections regarding the Sambhar been brought to the notice of the Government of India?—They have come from the Government of India.

33. Q. (*Mr. Ibbetson.*)—For how many years have these Agricultural Companies been formed?—About six years.

34. Q. Who are the members?—Mostly local people.

35. Q. Chiefly officials and money-lenders?—No.

36. Q. Who started the movements?—I did. Agricultural Company is a registered company consisting of *jagirdars*, bankers, and local officials.

37. Q. What is their security?—The security is the profit of their investment.

38. Q. Does it pay them well?—Yes. For instance the Jubilee Sagar pays about 14 per cent. From the State we get money at 6 per cent. and advance at 9 per cent.

39. Q. Do you think the movement will continue on its own motion?—No. For some years to come the movement will require my fostering care. Great difficulty was experienced in overcoming the diffidence of the *bohras* or local bankers. Now they have come to see that the State recognises their rights.

40. Q. Has anything been attempted in the form of co-operative Associations—that is, not for profit—but for mutual assistance?—We have agricultural banks which borrow money from *bohras* or failing them from the State.

41. Q. I suppose they divide no profit?—No. The profit goes to the reserve fund.

42. Q. Is that movement spreading?—Yes; it is only two years old.

43. Q. Do you think it is going to be a success?—Yes. To get a few people out of a village to form a company is not practicable. But I find in existence a very compact village community. They have already several interests in common managed by a *panchayat*—for instance they manage the village funds. I have utilised these *panchayats* and consolidated them into a company and they borrow money at a reduced rate of interest which they give to persons of good character. The result of the *bohra* lending to the *panchayat* is that the *panchayat* pays 9 per cent. or even in some cases 6 per cent. instead of 18. Then it has safer security. The *bohras* have the first lien on the *panchayat* and are in some cases now competing with each other.

44. Q. Is any pressure put upon the *bohras*?—No.

45. Q. The security which the *panchayat* gives is a personal security?—Yes, but they have power to levy any tax among themselves. The *panchayat* represents the community who are all responsible.

46. Q. So that they really pledge the village revenues?—No—the cultivator's share of the produce.

47. Q. How can they pledge this?—The *panchayat* advances money to approved cultivators on the security of their assets, and is empowered to realise its advances by attachment and sale of their respective shares of the produce without having to go to the Civil Court.—The *panchayat* borrows its working capital from a banker or from the State, and if its transactions with the cultivators result in a loss, the *panchayat* makes good that loss by levying a tax among the people, along with other commercial taxes once a year.

48. Q. In regard to this Rupnagar question you attribute the fall in the sub-soil water to two causes—recent drought and the construction of bunds. I suppose that in the course of time the effect of drought should disappear, so that really as a matter of permanency all you have to con-

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sider is the bunds? If they were removed your wells would recover their normal condition?—Yes.

49. *Q.* What does a well 90' deep cost?—Rs. 1,000 if blasting is involved.

50. *Q.* How many acres would that irrigate?—About 5 acres or 15 bighas each year.

51. *Q.* Is it worth while to dig a well costing Rs. 1,000 which irrigates only 5 acres?—Yes.

52. *Q.* The crops must be very valuable. What are they?—Cotton is the crop the cultivators like to grow, but we bring pressure to make them irrigate wheat and barley.

53. *Q.* What is the area of a bigha?—Half of an acre approximately. Our theoretical bigha is 132' square. The practical bigha is ⅗ of an acre.

54. *Q.* Is the area irrigated by these wells largely reduced in a famine year?—Yes, very largely reduced. Diminished in fact by ⅔rds.

55. *Q.* So that your 5-acre well would in a famine year irrigate about 1⅔ acres?—No, more than 1⅓ acres. The reduction of water is greater in the higher level and less in the lower. These wells are a real protection against famine. The holdings are small and well manured.

56. *Q.* At any rate the protection against famine would be small seeing that the crop grown is cotton and the area is very much diminished?—They don't grow cotton in a famine year.

57. *Q.* You mean that the cotton fails and they have to sow something else. Is not cotton sown long before they know what the rains are going to be like?—It is generally sown in the chhota barsat or early monsoon. The wells are a very good insurance against famine.

58. *Q.* You mean they make the people prosperous and better able to resist famine?—Yes.

59. *Q.* Since the State bears the cost of a well which fails the people do not mind about the risk of failure. This seems to me to be always a danger; could you not guard against it?—The site is generally approved by the village revenue authorities before the advance is given for a well. The *panchayat* considers the site. They even consult an opposite faction, if necessary.

60. *Q.* Do you think a test boring would be a greater security?—Yes, I am thinking of trying it.

61. *Q.* You grow a great deal of cotton in the State. Is there any black cotton soil?—A little in the southern part.

62. *Q.* Do the people irrigate it freely?—Yes, both in *kharif* and *rabi* and it requires less water than sandy soil.

63. *Q.* I understood that owing to cracks in the soil you could not irrigate black cotton soil with small quantities of water. Are you speaking of irrigation from wells?—No. Irrigation from tanks. They make very small *kiaris*.

64. *Q.* (*Mr. Higham.*)—When do they take the water?—Whenever they want it. They require most water in the sandy and lighter soil.

65. *Q.* What crops are grown on the black cotton soil?—Cotton and *makka*.

66. *Q.* When do they sow the cotton?—They sow cotton on the well-irrigated land early in May and on tank lands a little later.

67. *Q.* Why do you charge more for black cotton soil?—We don't.

68. *Q.* Looking at the table I see that both your tanks and well irrigation has increased since the good year of 1897-98.—Yes. Sixteen inches of rain is generally sufficient for our requirements if we have timely showers.

69. *Q.* Your well area has also increased?—Yes. We have added 12 per cent. to the number of wells during the past 12 years.

70. *Q.* (*Mr. Rajaratna Mdlr.*)—Does the black cotton soil crack during the hot weather?—Yes. It is not the black cotton soil of the Central Provinces. It more resembles that of Kotah, Jhalawar, and Malwa.

WITNESS No. 7.—MR. MANNERS-SMITH, Superintending Engineer, on special duty.

Mr. Manners Smith.

19 Nov. 01.

1. *Q.* (*The President*)—You have been deputed to study the improvements in irrigation possible in Native States?—Yes, to assist those States which have no Engineer of their own in preparing information for the Commission.

2. *Q.* Of these Kishengarh is one?—Yes.

3. *Q.* Have you much hope as regards the Khari river project?—The Khari river project was thought of for Ajmer in 1884. The headworks of the canal were to be at Garwar in Meywar territory. The Meywar Durbar objected. Afterwards Meywar (Mr. Monkton being State Engineer) prepared a project of their own for the Khari. Two States, Meywar and Shahpura, and Ajmer have proposed projects for this river. The idea for Ajmer was to take out a canal and fill a series of existing tanks.

4. *Q.* Is it a river in which you can store water?—There is no place for storage in the river itself. Down below the bed is very sandy.

5. *Q.* Is it deep below the surface?—In some places the banks of the river are fairly deep.

6. *Q.* Have you gone into the question of the claims of the Salt Department?—I was put on special duty in connection with the Salt Lake question. It arose originally during the late famine. Ajmer was building the Ontra Tank as a famine relief work and the Salt Commissioner objected to its being made. Finally the Government of India stopped our going on with the work. Since that, in April last, Mr. Dane wrote to the Government of India not only objecting to the construction of new tanks but also suggesting the removal of existing tanks. The Government of India has ordered us to take observations of discharges of the river for a series of years to observe the effect of rainfall in the catchment. They also asked for opinion on Mr. Dane's proposals and have laid down a rule that no new works or improvements to tanks are to be made without consulting the Commissioner of Salt Revenue. My Superintending Engineer has asked me to bring up this case as showing the difficulties of extending irrigation in Kishengarh and Ajmer. (*Witness shows statement of discharges*). These discharges were taken partly by Kishengarh, partly by the Public Works Department and partly by the Salt Department, and are perhaps not altogether reliable. One discharge shows that you lose ⅔ths of the discharge in 16 miles, with rainfall up to 1¾ inches throughout catchment. Mr. Dane contends that with heavy rain in Ajmer the rain reaches Sambhar Lake. If you have more than 2 feet 6 inches of water in the lake it delays the manufacture of salt.

7. *Q.* (*Mr. Higham.*)—What is the general conclusion you have come to?—My conclusion is that if there is rain in Ajmer and none below, moderate floods would never reach Sambhar and if heavy floods, only a small portion.

8. *Q.* Are there any other works in Kishengarh which you think feasible?—Kishengarh has taken advantage of nearly every site available. There are four possible sites, three of which are in the catchment of Sambhar; one very good one at Manpura.

9. *Q.* Is that one of those objected to?—Yes.

10. *Q.* As regards this river Khari, is Garwar undoubtedly the best site? Have you had a chance of examining it?—No; but it has been examined by numerous engineers and they have all settled on that one site.

WITNESS No. 8.—MR. A. N. THORPE, State Engineer, Dholpur.

Mr. Thorpe.

19 Nov. 01.

Witness put in the following documents:—

1. Copy of printed report on Irrigation in Dholpur State.

2. Statement of existing Famine Protective Works, Jaipur State.

3. Statement of proposed works.

4. A map of the State.

1. Q. You are State Engineer of Dholpur?—Yes; I have been in the State 12 years.

2. Q. You have seen it through a famine?—Yes; I was also Famine officer.

3. Q. I gather that irrigation has not received much attention?—No; the financial condition of the State precluded it.

4. Q. Has any attention been paid to the subject at all?—Well irrigation has been encouraged. I could not get money for a number of projects for tank irrigation.

5. Q. I notice a vast number of ravines in this State. Have any means been taken to prevent their increasing? Are bunds thrown across them?—The zemindars do it themselves, but no help is given them.

6. Q. You have a project for a bund in the Parbati?—Yes; the detailed project has not yet been prepared. It will be a large project for irrigating by storage and inundation.

7. Q. Would it pay to make bunds round the fields as is done in Bhartpur?—I have seen some of the Bhartpur works; similar works would not be possible in Dholpur; but all our fields are more or less surrounded by mud walls 4 or 5 feet high to keep out pig and deer. These hold up water.

8. Q. Regarding the maximum depth of wells referred to in paragraph 8 (iv) of your report—surely they don't use for irrigation a well 150 feet deep?—Yes, that is, the well is used where the spring level is 150 feet deep. The actual water-level rises to 60 feet from the surface, but the spring is at 120 feet or 150 feet. The working depth is 60 feet.

9. Q. (*Mr. Higham.*)—Are tanks made by private individuals?—Very seldom.

10. Q. Is takavi given freely?—There is a takavi fund and what is available is given out.

11. Q. (*The President.*)—Then you go on to say, "Productive works take the case of the Tals made in 1896-97—Nurpura certainly brings in 6 per cent. on an outlay of Rs. 17,000, but it might bring in much more, as only one bed is cultivated for *rabi* and the whole of the water absolutely runs to waste." The bed of the tanks must be very large. What are the Revenue rates?—About Rs. 4 an acre on the Furpula tank. This includes everything. The land was formerly uncultivated.

12. Q. Do they not cultivate below the tank?—Cultivators will not use water for irrigating below tanks though the sluices are there and the land is there. The people prefer wells to tanks.

13. Q. What do you do with your famine people?—We employ them on tanks.

14. Q. Was a programme ready when the famine came on?—No; it caught us asleep.

15. Q. How many did you employ in Dholpur?—Twenty-thousand out of a population of 281,000.

16. Q. Many people emigrated?—No, a few only emigrated. There was not much mortality.

17. Q. Have you a programme for future years?—Yes.

18. Q. Has this programme of works been got up with a view to being held in reserve in case of famine?—Yes. *Mr. Thorpe.*

19. Q. When was it got out?—In 1896-97. We go on adding as we find sites for tanks 19 Nov. 01.

20. Q. Were all the works which were put in hand last famine completed during the famine?—No; they were completed after the famine.

21. Q. Financially have they been a success?—I think so. They all filled up in 1898; the beds were cultivated and spring level kept up for ½ to 1 mile beyond them.

22. Q. What is the system of charging for water from the tank?—Tanks are assessed with the villages at the time of Settlement and are included in the village "jama."

23. Q. That is, provided the tank existed when the settlement was made. In the case of a new tank there is no enhancement?—No, that will come next settlement; in two years there will be a new settlement.

24. Q. There is nothing in the shape of a water-rate levied?—No, nothing at present.

25. Q. Do you know the cost of the works that have been made?—Yes, this gives the cost (*produces statement.*)

26 Q. The cost of the irrigation works as a whole?—No. Some date from the Mahomedan Emperors' time; of these there is no record.

27. Q. The projects entered here are not surveyed I suppose, you are surveying them?—Are any of them likely to be carried out except under stress of famine?—I don't think so—at any rate for the next four years. The State is in debt. If there is no famine it should be free in four years. Meanwhile we go on surveying.

28. Q. Are there any Rajputana States below Dholpur?—No; the only State above is Karauli. It has never interfered with us.

29. Q. (*Mr. Ibbetson.*)—I did not catch your answer to the President's question about the Bhartpur works where a great deal has been done to spread the water over the country. Could not this be done at Dholpur?—No. We could not dam the nallahs in the same way—they are deep and not shallow as in Bhartpur.

30. Q. And I understand generally that the configuration of the country is such that there is not much scope for storage tanks?—There is great scope for storage tanks—not for inundation works.

31. Q. Then you say the people won't take the tank water if they have wells. In the famine year didn't they take the water?—No, they didn't want the water; they preferred their wells which the tank kept going.

32. Q. So they don't want the water?—They don't like paying water rate.

33. Q. I thought you said there was no water-rate. Do you only mean that there is no water-rate because the water is not taken?—Yes.

34. Q. So that your experience up to date does not prove conclusively that your tank, will not pay in the end. Your system has not paid because it is not complete?—Yes. I am extending the channels now beyond the well area so as to take up new land.

WITNESS No. 9.—MR. G. E. C. WAKEFIELD, Superintendent of Land Revenue, Tonk.

Witness put in the following documents:—

1. Statement No. I, showing the existing tanks in the Tonk Pergana.

2. Statement No. II, of proposed new tanks.

3. Statement No. III, showing area irrigated by rivers.

4. Preliminary investigation report, Famine Protective Works (printed below.)

Report on the desirability and possibilities of constructing Protective Irrigation works in the Tonk State, Rajputana.

Note.—No serious attempt has hitherto been made in this State in the direction of irrigation. The usual village tanks exist and a few new ones were hurriedly constructed during the late famine. It is, therefore, not possible to give technical information regarding catchment areas, capacity and command as required in the Government of India note on the scope of the Preliminary Investigation. This information will be collected during the coming cold weather.

The Tonk State with an area of 2,564-67 square miles consists of six detached provinces; Tonk, Aligarh, and Nimbahera lying in Rajputana and Pirawa, Sirong, and Chabra, in Central India. The State, although financially embarrassed, is rich in good lands and undeveloped opportunities in the direction of irrigation. From the statement attached it will be seen that in three provinces out of six less grain is actually produced than is absolutely necessary for the year's consumption; and in the State taken as a whole, with yearly requirements amounting to 2,118, 200 maunds, the produce amounts to 24,66,876 maunds, *i.e.*, only 348,676 maunds in excess of requirements. The produce should be at least a year's supply in excess, the actual excess is barely sufficient for two months. On the other hand there are 743,192 acres of good culturable land lying fallow, estimated to produce 4,030,664 maunds yearly, if cultivated. Even if a third of this area could be brought under cultivation with the help of irrigation, the produce would help considerably to supply the present dangerous deficiency. *Mr. Wakefield.* 19 Nov. 01.

It is only necessary to add that during the late Famine

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the State, taken as a whole, lost 28 per cent. of its population, and 24 per cent. of its cattle. One province, Nimbahera, losing 38 per cent. of its population and 75 per cent. of its cattle.

The report was required by the middle of September. Time and the rains did not therefore allow of a field reconnaisance. All that it was possible to do under the circumstances was to mark on maps the likely commanded areas of likely rivers and streams to flat cross-sectional lines within these and from them to estimate the number of miles of levels to be taken and the expenditure, to enable the likely country to be contoured when it will be possible to fix reliable sites for large reservoirs, tanks, and canals. This has been done and separate maps and statements are submitted for each province. An abstract of those statements is also attached, and a statement showing the number of wells in use in the state and the ratio of well irrigated to dry cultivated lands. It will be seen that in this direction also there is much room for improvement.

Tonk State.

Estimate of Cost of Preliminary Irrigation Investigation.

Province.—Tonk.

Normal rainfall.—25 inches.

Projects.—1. Banas River, 2. Masri River, 3. Tori Naddi, 4. Bhamor Nallah.

1146 miles of levelling at three miles daily including plotting, per party of two levellers working together but with separate instruments, and one surveyor.

Note.—North of the Banas River (*vide* plan) the cross sections will be ¼th mile apart owing to this quickly varying nature of the country. South of the river they will be taken ½ mile apart as the country is comparatively level.

Description.	Amount. Rs. A. P.
Four levellers and two surveyors at Rs. 50 each including travelling allowance for seven months	2,100 0 0
15 Khalasis at Rs. 5 each for seven months	1,750 0 0
12,000 wooden level pegs at Re.1 per cent.	120 0 0
50 flags at 6 annas each	18 12 0
Total	3,988 12 0
Contingencies at 5 per cent.	200 0 0
GRAND TOTAL	4,188 12 0

Estimate of Cost of Preliminary Irrigation Investigation.

Province—Nimbahera.

Normal rainfall—25 inches.

Projects.—1. Gameri River, 2. Kadamatti River, 3 Keli Naddi, 4. Sangesra Naddi, 5. Pind Naddi, 6. Chekara Naddi.

650 miles of levelling at three miles daily including plotting, per party of two levellers working together but with separate instruments, and one surveyor. Cross sections ¼th mile a part and levels every 500'.

Description.	Amount. Rs. A. P.
Two levellers and one surveyor at Rs. 50 each including travelling allowance for seven months	1,050 0 0
25 Khalasis at Rs. 5 each for seven months	875 0 0
7,000 pegs at Re 1 per cent.	70 0 0
25 flags at 6 annas each	9 6 0
Total	2,004 6 0
Contingencies at 5 per cent.	100 0 0
GRAND TOTAL	2,104 6 0

Estimate of Cost of Preliminary Irrigation Investigation.

Province—Pirawa.

Normal rainfall—30 inches.

Projects.—1. Chanli Naddi, 2. Richhar Naddi.

402 miles of levelling, at three miles daily including plotting, per party of two levellers working together but with separate instruments and one surveyor. Cross sections ¼th mile apart and levels every 500'.

Description.	Amount. Rs. A. P.
Two levellers and one surveyor at Rs. 50 each including travelling allowance for five months	750 0 0
25 Khalasis at Rs. 5 for five months	625 0 0
4,100 level pegs at Re. 1 per cent.	41 0 0
25 flags at 6 annas each	9 6 0
Total	1,425 6 0
Contingencies at 5 per cent.	71 4 0
Grand Total	1,496 10 0

Estimate of Cost of Preliminary Irrigation Investigation.

Province—Sironj.

Normal rainfall—30 inches.

Projects.—1. Jaori Naddi, 2. Kaetnan Naddi, 3. Pinsi Naddi, 4. Kali Sind River.

1111 miles of levelling, at three miles daily including plotting, per party of two levellers working together but with separate instruments and one surveyor. Cross sections ¼th mile apart and levels at every 500'.

Description.	Amount. Rs. A. P.
Four levellers and two surveyors at Rs. 50 each including travelling allowance for six months	1,800 0 0
50 Khalasis at Rs. 5 each for six months	1,500 0 0
50 flags at 6 annas each	18 12 0
11,300 level pegs at Re. 1 per cent.	113 0 0
Total	3,431 12 0
Contingencies at 5 per cent.	171 8 0
Grand Total	3,603 4 0

Estimate of Cost of Preliminary Irrigation Investigation.

Province—Chabra.

Normal rainfall—30 inches.

Projects.—1. Retti River, 2. Parbati River, 3. Anderi River.

451 miles of levelling, at three miles daily including plotting, per party of two levellers working together but with separate instruments, and one surveyor. Cross sections ¼th mile apart and levels every 500'.

Description.	Amount. Rs. A. P.
Two levellers and one surveyor at Rs. 50 each including travelling allowance for five months	750 0 0
25 Khalasis at Rs. 5 each for five months	625 0 0
4,600 wooden level pegs at Re. 1 per cent.	46 0 0
25 flags at 6 annas each	9 6 0
Total	1,430 6 0
Contingencies at 5 per cent	71 8 0
GRAND TOTAL	1,501 14 0

Statement of Population, Food Requirements, Produce and Possibilities.

Name of Province.	FACTS.										POSSIBILITIES.	
	Population, 1891.		Grain eating animals.		Lands under grain.			Lands under grain.			Cultivable lands.	
	Numbers.	Yearly food requirements in maunds estimated at 3 seer each daily including children.	Numbers.	Yearly food requirements in maunds estimated at 1 seer each daily.	Area (in acres).	Actual yearly seed requirements (in maunds).	Total yearly requirements Columns 3, 5 and 7 in maunds.	Area (in acres).	Produce (in maunds).	+ or —difference between produce and requirements.	Area (in acres).	Estimated produce (in maunds).
1	2	3	4	5	6	7	8	9	10	11	12	13
Tonk . . .	114,293	521,485	9,635	41,119	147,437	72,099	638,534	147,437	735,162	+96,568	133,006	665,030
Aligarh . .	19,622	83,525	890	3,121	44,622	18,497	116,143	44,622	260,357	+144,214	37,285	218,117
Nimbahera .	64,833	295,051	3,075	23,000	67,918	30,984	351,995	67,918	263,188	—91,807	96,693	629,785
Pirawa . .	40,805	186,177	2,199	20,035	43,431	11,795	218,038	44,431	303 955	+85,917	72,113	493,974
Sironj . .	93,856	428,218	3,852	35,165	83,693	47,505	510,909	89,693	461,326	—49,583	342,272	1,754,144
Chabra . .	46,322	211,663	3,351	30,578	60,335	37,279	279,521	60,335	261,403	—15,112	61,626	269,614
Total .	3,73,852	1,733,120	17,951	163,130	451,636	218,950	2,116,200	451,636	2,455,876	+338,676	743,192	4,030,664

Statement regarding Agricultural Wells.

Province.	Wells.		Total cultivated lands (in acres).	Percentage of well-irrigated area to total area.
	Numbers	Irrigated land (in acres).		
Tonk	6,628	28,622	186,901	15·3
Aligarh	1,616	9,139	51,203	16·9
Nimbahera	5,019	18,919	99,616	19·0
Pirawa	2,695	12,760	59,491	21·4
Sironj	1,761	2,727	124,621	2·2
Chabra	3,111	6,766	77,836	8·6
Total .	20,913	78,933	602,674	13·0

Abstract of Estimate of cost of Preliminary Irrigation Investigation.

Province.	Miles of levelling necessary.	Time required (months).	Establishment and cost.															
			Levellers at Rs. 80.	Amount.	Levellers at Rs. 50	Amount.	Khalasis at Rs. 5.	Amount.	Level pegs at Re. 1 per cent.	Amount.	Flags at 6 annas.	Amount.	Total amount.	Contingencies at Rs. 5 per cent.	Grand Total cost.			
				Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.			
Tonk . . .	1,136	7	4	1,400 0 0	2	700 0 0	50	1,750 0 0	12,000	120 0 0	50	18 12 0	3,988 12 0	200 0 0	4,188 12 0			
Nimbahera .	550	7	2	700 0 0	1	350 0 0	25	875 0 0	7,000	70 0 0	25	9 6 0	2,01 6 0	100 0 0	2,104 6 0			
Pirawa . .	402	5	2	500 0 0	1	250 0 0	25	625 0 0	4,100	41 0 0	25	9 6 0	1,425 6 0	71 4 0	1,496 10 0			
Sironj . .	1,111	6	4	1,200 0 0	2	600 0 0	50	1,500 0 0	11,300	113 0 0	50	18 12 0	3,431 12 0	171 0 0	3,603 4 0			
Chabra .	461	5	2	500 0 0	1	250 0 0	25	625 0 0	4,600	46 0 0	25	9 6 0	1,430 0 0	71 8 0	1,501 14 0			
Total . .	3,760	...	14	4,300 0 0	7	2,150 0 0	175	5,375 0 0	39,000	390 0 0	175	65 10 0	12,280 4 0	613 12 0	12,894 14 0			

Mr. Wakefield.

19 Nov. 01.

Copy of a note by Superintendent, Public Works Department and Assistant Revenue Superintendent, Tonk State, dated 25th October 1901.

The following table shows the number of existing tanks belonging to the State :—

(*a*)

Perganas.	Old Tanks.		New tanks built in last Famine.	Total.
	Repaired in last Famine	Others.		
Tonk . . .	8	400	2	410
Aligarh . . .	2	78	1	81
Nimbahera . .	3	113	3	119
Pirawa . . .	5	36	3	44
Chabra . . .	1	42	...	43
Sironj . . .	...	230	1	231
Total .	19	899	10	928

(*b*) Out of the old tanks there are 53 and out of the new tanks there are 8 from which water is used for irrigation. List No. 1 gives particulars as to locality, area irrigated, etc.; 865 of the old and two of the new tanks are used for watering cattle only.

(*c*) Sites for new tanks, as far as were known, have been entered in list No. 2. The districts of the States are scattered and the distances between them are great. Time and means were necessary to search for sites.

2. (*a*) List No. 3 gives particulars regarding the rivers such as duration of flow, area irrigated, etc.

(*b*) Many of the rivers could be utilized for irrigation; sites for bunds have been suggested by the villagers but projects have not been investigated. Mr. Wakefield has shown in his report, dated 21st September 1901, what should be done with regard to these rivers.

(*c*) If Colonel Jacob's project of a canal from the Banas river, proposed in 1885, be carried out, a large portion of the Tonk Pargana, south of the river Banas, will be brought under irrigation.

3. Experience during the Famine of 1868-1869 and of 1899-1900 has shown that wells with good sub-soil water sources are much beneficial in the year of drought. There are many portions of districts favourable for such wells. Sub-soil water-supply is enhanced by the construction of reservoirs and tanks. In a year of famine the relief works should consist of construction of tanks and as well as digging of wells.

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1. *Q.* (*The President*)—You are Superintendent of Land Revenue in Tonk?—Yes.

2. *Q.* You are an Engineer?—Yes.

3. *Q.* How long have you been at Tonk?—A year.

4. *Q.* You suffered very badly in the famine in Tonk?—Yes, very severely.

5. *Q.* What is the rainfall of Tonk?

In 1894, 30·28 inches; in 1895, 13·10 inches.
„ 1896, 16·99 „ „ 1897, 22·51 „
„ 1898, 15·44 „ „ 1899, 10·41 „
„ 1900, 27·80 „ „ 1901, 11·90 „

6. *Q.* Is it possible to strike an average for this?—I am afraid it is not. The State consists of a number of detached provinces.

7. *Q.* In three out of six provinces less grain is produced than is required. Is anything else grown?—Yes, opium.

8. *Q.* It is a very valuable crop?—Yes.

9. *Q.* I suppose that is the reason food crops are not grown?—To a certain extent, yes; opium depends on the rainfall and the area is declining yearly; also the value of the crop is decreasing.

10. *Q.* Was there great mortality during the famine?—Yes, terrible.

11. *Q.* Were the tanks all empty in the famine?—Almost all.

12. *Q.* Do you think they did any good?—Yes; some tanks which had water undoubtedly did good.

13. *Q.* Had you any difficulty about drinking water?—Yes—very great difficulty. In some cases it had to be carried for miles.

14. *Q.* There are 78,965 acres under wells?—Yes.

15. *Q.* That, I suppose, is the favourite form of irrigation in the country?—Yes. The figures represent the area under wells in 1890 when the settlement took place. The number has been going down steadily ever since. In 51 villages which I inspected, out of 645 wells, 402 were absolutely dry. The remaining 243 were working precariously. The depth to water used to be 30 or 40 feet; it has now sunk by 15 feet.

16. *Q.* You say that the whole area of Tonk is 1,600,000 and the total cultivation 200,000 acres?—Yes, there is a great deal of forest country and hills.

17. *Q.* Is the soil good what there is of it?—Yes, very good indeed. It is almost entirely black cotton soil, which would take water readily if it could get it.

18. *Q.* Would it take water in ordinary years?—Yes

19. *Q.* Has the scare of famine not induced the people to make more wells?—They would make the wells but they have not got the means.

20. *Q.* Does the State give takavi advances?—It does to the best of its ability, but it is in debt. The takavi in 1900-01 amounted to Rs. 1,88,000 and in 1901-02 the budget provision is Rs. 70,000.

21. *Q.* Was that chiefly for wells?—No, for seed and cattle. Rs. 70,000 is what is ordinarily given.

22. *Q.* But in ordinary times the cultivators would not be buying seed?—The cultivators have to be supplied with almost all the seed they sow.

23. *Q.* (*Mr. Ibbetson*)—So there is very little left for wells?—Very little. In the famine we gave about Rs. 10,000 exclusively for wells.

24. *Q.* (*The President*)—Do you know the terms on which takavi is given?—For ordinary takavi we charge 12 per cent. and try to recover in a year; for wells, 6 per cent. and recover as the cultivators can pay.

25. *Q.* Have you had time to examine the larger projects?—I have not. I have seen all the provinces and submitted maps. Projects could not be prepared without levels.

26. *Q.* If Colonel Jacob's project for a canal from the Banas were carried out would Tonk be prepared to pay its share?—Yes, if it had the money.

27. *Q.* As far as Tonk is concerned it could not be carried out just now?—I don't think so—it is too big. I would advocate the Punjab system of bunds and small inundation cuts. It is done in the Tonk province of Sironj in Central India where the soil is entirely black cotton.

28. *Q.* Did you have great emigration during the famine?—Not very great. During the famine a good many outsiders came in.

29. *Q.* (*Mr. Higham*)—As regards the statement No. 1 for existing tanks you give the area irrigated by tanks?—I would like to make a statement about these figures. In my original report I said it would be very much better not to call for these statistics because they could not be reliable. These statements were prepared when I was away. The figures are not reliable—no records were kept. These are kept now.

30. *Q.* Is any revenue demand made on such land?—We treat them as well-irrigated lands but the assessment is fluctuating—that on wells is fixed. We measure up the area irrigated from the tanks and charge on that.

31. *Q.* As regards statement No. 2, would these works be of a different character from the old tanks—would they be useless in a dry year?—I think the figures must represent maximum areas. The old tanks in drought irrigated practically nothing.

32. Q. The fact that the old tanks did not irrigate was not entirely due to short rainfall?—No, I don't think so. The old tanks are useless because they are in a state of disrepair—the people cannot afford to repair them now unaided.

33. Q. Do they fill and burst?—In some cases.

34. Q. Who selected all these new tanks in the different provinces?—I did some; others were selected by villagers, and from here to here (*points out on map*) by the Public Works Superintendent who has been in the State for years. There was absolutely no time to make surveys.

35. Q. The statement was prepared in view of our visit?—Yes.

36. Q. Would they depend entirely on rainfall?—Entirely, in the first given in the statement we want to close a nullah; I have already finished the survey for this.

37. Q. Have any of the others been surveyed?—No.

38. Q. How do you attain the area you propose to irrigate?—These figures are not reliable.

39. Q. Who entered them?—The Superintendent of Public Works.

40. Q. Do you know anything of the Banas river proposal?—I have read through Colonel Jacob's project.

41. Q. Would that do any good in your State?—It takes up 103 miles.

42. Q. Would the State be able to bear its share of the cost?—No, not without help.

43. Q. Do you want a loan?—Yes, but I think it would be more profitable for the State to spend any money it could obtain on smaller works than on any large project.

44. Q. The Banas scheme would be more profitable than a small project?—No.

45. Q. Supposing it were supplemented by storage works?—Yes, that would be all right, but it would be a big business.

46. Q. (*Mr. Ibbetson*)—You say that all your projects are entirely for storage of rain?—Yes.

47. Q. And there are no streams in the State?—We have lots of streams. I have sent in maps showing every province and the streams that could be utilized—perennial and others.

48. Q. There is scope for storage?—Yes.

49. Q. The provinces of Tonk being so scattered do you anticipate any difficulty with other States if you try in the future to store?—I do not think so. The streams rise in our own territories, except the Banas.

50. Q. How about the States below to which the water would go if you did not impound?—We should be entitled to a share of the water.

51. Q. You said just now that the area under opium is yearly declining because it is dependent on the rain. You don't mean they grow opium from the rain?—No, but the wells are suffering for want of rain. There are one or two instances in the Pirawa Province where they do have barani opium. It is very exceptional.

52. Q. Then I suppose if you had money to give as takavi it would not stimulate the people to make new wells or do you think it would?—I think now is the time to stimulate them.

53. Q. If you had money to give they would be able to make new wells?—I think so. *Mr. Wakefield.*

54. Q. Can you tell me whether before this period of short rainfall wells did pay well?—Most distinctly. All the arrears of revenue date back only about six years. 19 Nov. 01.

55. Q. The people would take money now, only it is not forthcoming?—Yes.

56. Q. Is the assessment fixed?—Yes.

57. Q. When does your settlement expire?—It varies; in one province 4 years remain, in three 5 years and in two 6 years

58. Q. What is the period?—Fifteen years.

59. Q. Suppose a man made a well this year would he then be assessed full revenue?—No, not if he made it after settlement started. He would not get consideration or any exemption for having made the well himself if made before settlement.

60. Q. Would not this prevent his taking takavi?—I don't think so. They could not afford to wait.

61. Q. In how many years do you recover takavi?—It depends on circumstances.

62. Q. You have to trust to the Tehsildar?—To a great extent, and the Governor of the province.

63. Q. You say there is a great deal done in Sironj in the way of small inundation channels. Would it not be possible to extend that?—To a very great extent. I think that is the line to take up throughout the State.

64. Q. What is wanted to extend it?—Money.

65. Q. Such works are mainly constructed by village labour, what do they want money for?—We want something for village labour to live on. The cultivator cannot work now without pay.

66. Q. You mean he would take your money and hire labour?—No, he would not.

67. Q. He would rather borrow your money and eat it and repay it afterwards?—Yes.

68. Q. Are you speaking from actual experience?—Yes.

69. Q. Would they take takavi for embanking?—Yes.

70. Q. What would be the cost of one of these bunds?—It would depend entirely on the area enclosed—Rs. 26 or Rs. 30.

71. Q. And they would not do that amount of labour?—Certainly not in Sironj.

72. Q. What area would the bund cultivate?—It would enclose a field.

73. Q. You refer to surface drainage. I misunderstood you; you do not mean a stream?—The slope is so great that a stream would hardly require a bund in Sironj. In the other Provinces streams would be bunded and diverted.

74. Q. What do they grow on this black cotton soil?—Wheat and also *kharif*. Both crops off the same soil.

75. Q. You have no experience of black cotton soil taking or refusing water?—No.

Colonel Jacob with the permission of the President here explained that if he looked at the matter of the Banas project solely from a Tonk point of view he would say do as Mr. Wakefield suggests, but he did not think the canal would be a success without storage connected with it.

WITNESS 10.—BABU DAMODAR RAO, Superintendent of Public Works, Tonk.

1. Q. (*The President*)—You are in charge of Public Works in Tonk?—Yes. *Babu Damodar Rao.*

2. Q. How long have you been there?—Fourteen years.

3. Q. What is your chief work?—Building roads.

4. Q. Not much to do with irrigation works?—In the famine year we constructed about 20 tanks. 19 Nov. 01.

5. Q. As famine relief labour?—Yes.

6. Q. Did you finish these tanks?—Sluices have to be made. The banks are finished.

7. Q. How many tanks are there?—About 29.

8. Q. Are you going on with the sluices?—Not yet; there is famine in two provinces for which we want all our money.

9. Q. Have you a programme of famine works?—We had one, but it was used up last famine. We are preparing a new one.

10. Q. Have you no relief works going on?—No.

11. Q. Is Tonk your native place?—No, I am an inhabitant of the Bombay Presidency.

12. Q. What do the people themselves like best for irrigation? What do they most trust to?—Mostly to wells in Tonk and Malwa; in Sironj to rain.

13. Q. Then in Sironj they have suffered most of all, I suppose?—In these famine years they have not suffered most.

14. Q. It has no tanks?—No; very few.

15. Q. It has not got wells?—No. In fact there is no *chahi* land. Both the monsoon currents favour that province.

16. Q. Did a great number of wells fail in Tonk?—Yes, a great number in the last famine and this year. Recently I visited a *jagir* village and out of 43 wells only 2 were not dry. They were on the bank of a nallah.

Babu Damodar Rao.

19 Nov. 01.

17. *Q.* Do private individuals make tanks?—No; the large number of tanks in Tonk were made in ancient times by Thakurs when a share of the produce was put by for the maintenance of tanks.

18. *Q.* Have you yourself had to build many tanks?—No, except those built in last famine. Advances for deepening wells, about Rs. 15,000, were given; a very small amount.

19. *Q.* Did any tanks hold water throughout the famine?—One tank—the Mahomedgad tank—held water. Its storage capacity is 64·3 million cubic feet, and it irrigates 300 bighas.

20. *Q.* Why don't they irrigate more?—Irrigated land is charged as *chahi*; if they irrigated new land it would be so charged.

21. *Q.* Would it not pay them even if it is *chahi*?—Yes, it would, but the villages being small they don't want the cultivation.

22. *Q.* Have you ever considered this Banas project?—Yes. It would benefit the southern portion of the Tonk province. It will cost too much for us. What we want is small tanks with wells round and below them.

23. *Q.* Are there no places where you could make big tanks?—In every province there are large streams, but they are between two States.

24. *Q.* Would it be very difficult to get two States to co-operate?—Yes, very difficult.

25. *Q.* Can you not fix a *panchayat* to settle that?—Yes the question has never been thought about.

26. *Q.* (*Mr. Higham*)—I see that during the last famine you repaired a few old tanks (19). Mr. Wakefield has told us that the old tanks were in a very bad state of repair and were of very little use. Have they always been used for watering cattle or were they used for irrigating?—The old tanks are mostly used for watering cattle. Many of them are breached. I don't think they were ever used for irrigation. When the beds are dry they are cultivated. They are only small tanks with beds of one to two acres. We will now repair some of these old tanks by relief labour—lengthen or raise the bund or repair breaches, etc.

27. *Q.* Have you a list of the works that might be repaired?—No, we have no list yet: it is being prepared.

28. *Q.* Did the existing tanks get water in them this year?—Yes. In Pirawa all the tanks filled. In Tonk and Nimbahera there was much less rainfall.

29. *Q.* Do you ever employ famine labour in connection with the construction of wells?—No.

30. *Q.* How deep are the wells?—Sixty feet to the bottom; 50 feet to water surface. The water level has gone down.

31. *Q.* Have you had much experience of tank irrigation or of seeing what a tank could irrigate?—No. In preparing the statement laid before the Commission I made a guess at the figures. I went chiefly on what I had seen in Ajmer and allowed 70 bighas per square mile of catchment.

32. *Q.* The areas shown as irrigated by rivers are what is cultivated in the bed of the nullah?—Yes.

33. *Q.* Is there any difficulty in finding water? Do they ever sink a well in a wrong place?—Yes, there is a difficulty. The people are guided by existing wells. Water is often deeper than they expect. In Tonk they sometimes meet a soft rock in which the water supply is not sufficient. When they come upon sand, about 30 feet down, water is plentiful.

34. *Q.* Have you ever tried boring before starting a well?—No, it has never been done; it would be of great use.

35. *Q.* (*Mr. Ibbetson*)—You said that under the old system part of the produce was set aside for the repair of the tank. Is this still done now that you have a fixed assessment?—No.

36. *Q.* Then the change in the system of assessment has been partly the cause of these tanks falling into disrepair?—Yes, nothing is set apart that must be spent on tanks. In *jagir* villages where the *batai* system is still in force the work of repairing tanks is better done than in other villages.

ELEVENTH DAY.

Ajmer, 22nd November 1901.

WITNESS No. 11.—K. B. SAHIBZADA HAMID-UZ-ZAFAR KHAN, Dewan of Bikaner.

Sahibzada Hamid-Uz-Zafar.

22 Nov. 01.

Witness put in the following documents:—

1. Preliminary Investigation Report, Famine Protective Works (printed below).

2. Statement of existing Famine Protective Works, Bikaner State.

3. Statement of proposed Works.

No. 2453—110, dated the 7th October 1901.

From—Sahibzada Hamid-Uz-Zafar Khan, Khan Bahadur, Diwan of Bikaner,

To—T. C. Edwards, Esq., C.S., Political Agent, Bikaner.

In compliance with paragraph 5 of your letter No. 1404 of the 16th July last, and also your letter No. 1807 of the 24th August last, I have the honour to forward herewith two statements, Part I, for the existing works and Part II for the proposed works. With these has been attached a map of the Bikaner State showing the position of the different works as numbered in the statements.

2. The geographical formation of the country being peculiar, the water level very low and no deep stream or river running through the country, I would point out at the outset that there are no genuine famine protective works in existence nor can any be proposed for the future by an unexpert. In Part I, however, we have endeavoured to add all the irrigation works that are in existence. Of these, Nos. 7 and 8 are the only completed works from which irrigation can be done in a year of drought, provided always that there be flood in the Ghaggar, and that it rains heavily in the hills. Nos. 1 and 6 may be of some use to the State in a famine year, if the Government can spare water from the Jumna and Sirhind Canals for this State. No. 2 is a dry stream, the flow of which depends upon the rainfall in Jaipur State, and is, therefore, not of much importance. Nos. 3 to 5 are existing tanks from which the State gardens are irrigated. The Gajner tank is a large one and of great use to people and cattle during the years of scarcity. The circumstances of No. 9 are more or less the same as of Nos. 7 and 8. In a year of excessive flood and when no water is required for the canals, the flood in the bed of the stream helps the winter crop cultivation.

3. As I have stated above no famine preventive works can be brought within the scope of Part II (Famine Irrigation Programme). The only useful famine relief works that can be thought of are either the construction of new tanks, deepening the old ones or bunding up of the nallahs, which, if filled with rain-water in a good year, may be of some use in the following dry year. These are illustrated on Nos. 1 to 6. On No. 7 has been entered a new canal proposed by the Revenue Officer, and No. 8 refers to the extension of the Sirhind Canal into the Hanumangarh and Mirzawala tahsils. Both these projects seem remunerative, but whether they are practicable or not I am unable to say. The opinion of an Engineer on the feasibility of these projects is necessary and also to show us where future famine relief works could be done. There are many useful works that can be done by famine labour and for these the Durbar would be most thankful for the Superintending Engineer's advice. But as all the tanks, bunds, etc., in the State depend on rainfall when there is no rain, they, of course, cannot supply water and hence cannot be called famine protective works.

Sahibzada Hamid-Uz-zafar.

22 Nov. 01.

1. Q. (*The President.*)—You are the Dewan of Bikanir State?—Yes.

2. Q. Have you been long in that capacity?—A little over four years. I went there after the famine in 1896.

3 Q. All those years have been very bad?—Yes.

4. Q. Which was the worst year in Bikanir?—1899 was the worst, because there was a famine of grass as well as a famine of water; next to that was 1896.

5. Q. The difficulties in the way of saving Bikanir in the time of famine seem to be very great. Has the population decreased much in these bad years by people going away?—Yes.

6. Q. Are the people coming back?—Lots of people came back last year. There is a certain portion still away.

7. Q. In Bikanir at a time when there is no famine what crop do they raise?—Only one crop—the *kharif*.

8 Q. How is that raised?—By the rainfall; the average rainfall is 10". The soil is sandy and does not require much water.

9. Q. What was the loss of population in the last famine?—A little over 250,000, about 30 per cent.

10 Q. That includes emigrants?—Yes.

11. Q. What do you consider would be the best protection to give the State against the return of such a calamity?—Irrigation is the best.

12. Q But where is water to be had?—Either from the north or from below the ground. We just touch the Punjab canals on the north side.

13. Q. You are aware that the canals from the Punjab pass through a dry country before they get to you. I am afraid we cannot hold out much hopes to Bikanir of a supply from that quarter?—That is the only way we can get canals. Can we not get a supply of water from the Sutlej river?—The country slopes towards Bikanir and the distance is not very great. We have flat country and good loam lands on the Punjab border. Already we get a little surplus water from the tail of the Abohar branch of the Sirhind Canal. We want it to be extended and to get a regular supply. We also get a small supply of water from the tail of the Hissar branch of the Western Jumna Canal. If necessary we could pump the water as we have found coal in the State.

14. Q. What is ordinarily the depth of your sub-soil water below the surface?—From 250' to 275'. A good *pakka* well, 10' diameter, costs about Rs. 20,000.

15. Q. (*Mr. Ibbetson.*)—Are there no *naddis*?—None at all. There are no streams but the Ghaggar and that is not a perennial stream. It only runs for a certain time in the year. It dries up in the sands near Suratgarh. I daresay near the north the water level is not so deep; it is about 150' to 200'.

16. Q. (*The President.*)—We are told generally that irrigation could not be profitably carried on where the depth exceeds 60'. Is there no well irrigation at all in the State?—Not a bit; I would not include the patchy ground here and there cultivated by *malis* from well water. In Sujangarh the water-level is extraordinarily high, only a little patch, where they have a little vegetable irrigation.

17. Q. What does your agricultural population do?—It depends mostly on live stock; the people live on cattle; whenever there is good rain they get enough *bajra* and *moth* to last them for two years. There is also a wild grass "*bhurat*" the seed of which is used as grain.

18. Q. (*Mr. Higham.*)—How much do you have to pay for the irrigation from Western Jumna Canal?—We don't get any statistics of the charge.

19. Q. Do you collect the water-rate?—We don't get the water-rate. Government gets it.

20. Q (*The President.*)—What is your *bigha*?—In the north it is $\frac{1}{8}$th of an acre. In other parts $\frac{27}{100}$th of an acre.

21. Q. (*Mr. Higham.*)—What area is irrigated?—In 1896—229 acres. The channels are very old and have not been cleaned for years.

22. Q. Do you irrigate a smaller area than you did ten or twenty years ago?—I could not tell. I have not got the figures.

23. Q. Where are these works you propose; have they been examined in any way?—No, unfortunately we have not got an engineer at present.

24. Q. Who has suggested them?—We have done it ourselves.

25. Q. You have simply thrown them out as suggestions without any idea of their possibility?—Yes.

26. Q. Where is this work No. 7 of your list—a new canal from the Sutlej?—(Witness described the alignment on the maps.)

27. Q. Supposing you got water from the river, what sort of country is it?—It is all level country.

28. Q What is the soil?—A good light loam, exactly the same as on the Ghaggar Canal.

29. Q.—Supposing you got *kharif* crops on this, what revenue could you get?—Re. 1 to Rs. 2-8 an acre; it depends on the kind of crop—sugarcane up to Rs. 2-8.

30. Q. A lot of water is required for sugarcane?—Yes.

31. Q. You have a fixed assessment?—Yes.

32 Q If they got water here they would be able to pay a water-rate?—Yes.

33. Q. In Ajmer they charge Rs. 8 for sugarcane and you say you could only afford to pay Rs. 2-8. Supposing you grow fodder crops what would you pay then?—The rates differ. I made a mistake; I should say Rs. 6 an acre for sugarcane; tobacco Rs. 5; cotton, wheat and other *rabi* crops Rs. 3-12; others Rs. 2-8; *paleo* Rs. 0-12; water for sowing Rs.1-8. These are the Ghaggar rates: they are in addition to the land revenue.

34. Q. Where does the water come from?—The Ghaggar Canal.

35. Q. What is the land revenue?—It varies from 2 to 6 annas.

36. Q. Supposing you got water in this part, could they not afford to pay higher than that?—Yes.

37. Q. (*Mr. Rajaratna Mdlr.*)—Is it money rent or the share system?—It is all taken in cash.

38. Q. (*Mr. Ibbetson.*)—Is it a fluctuating assessment changing every year?—No, it is mostly a fixed sum.

39. Q. (*Mr. Higham.*)—You said wells are about 250' deep Are there any wells in the valley of the Ghaggar?—Yes, there were some there.

40 Q. After the floods does the water rise; do they do any cultivation from it?—Yes; the water rises in flood time and sinks to 50 feet afterwards; they grow *rabi* on the flood water.

41. Q. Don't they irrigate from wells?—No, they don't have enough water.

42. Q. Wells are only used for drinking purposes?—Yes.

43. Q. (*Mr. Rajaratna Mudlr.*)—You said the cultivators depend largely upon cattle breeding. Is cattle-breeding carried out to any large extent?—Yes, in comparsion with other things it is.

44. Q. How many cattle are sold annually?—I don't know.

45. Q. I want to know if you have any idea whether that industry enables them to tide over an ordinary famine?—In ordinary years it does.

46. Q. (*The President.*)—You must have lost a great number of cattle last famine?—Yes, we did.

47. Q. How many?—I don't know.

48. Q. (*Mr. Rajaratna Mdlr*).—Do you give any special encouragement to the breeding of cattle?—No; there is so much land that if anyone wishes to take it he can do so.

49. Q. You don't levy any taxes on pasture lands?—No.

50. Q. (*Mr. Ibbetson.*)—Do they ever put up high banks round their fields to keep in rain water?—I have never seen it done, but I am told where the soil is hard and high (*Magra*) they do put up high banks.

51. Q. I suppose from a great deal of the soil very little water flows off even without embankments?—Yes.

52. Q. On the stiffer soil you think it would do some good to put embankments round the fields?—Yes.

53 Q. Could much be done in that way to help them?—I don't know.

54 Q. Supposing you get 10" rainfall, say, 5" sink in and 5" flow away, if you had embankments round your fields would not that make a difference?—They don't want much water for a *kharif* crop; they never cultivate the land; they simply plough in front and sow behind as they go along.

Sahibzada Hamid-Uz-zafar.

22 Nov. 01.

55. *Q.* There would not be enough water for *rabi*?—No, not even for good crops of cotton. There is only enough for the inferior grain they grow there.

56. *Q. (The President.)*—Is your coal going to be a good thing?—I am afraid it is not a good class of coal.

57. *Q.* Is there plenty of it?—Yes.

58. *Q.* Is it deep or near the surface?—250 feet below the surface.

59. *Q.*—Where is it?—About 13 miles to the south of Bikanir.

60. *Q.* Is it in the railway?—We have a siding to it.

WITNESS No. 12.—MR. TICKELL, Executive Engineer, Kotah.

Mr. Tickell.

22 Nov. 01.

Witness put in the following documents:—

1. Letter No. 403-C., dated 28th September 1901, from Political Agent, Kotah and Jhalawar, with enclosures (printed below).

Letter No. 403-C., dated Camp, Jhalrapatan, the 28th September 1901.

From—Captain R. B. Berkeley, I. S. C., Political Agent, Kotah,

To—G. G. White, Esq., M.I.C.E., Secretary to the Hon'ble the Agents to the Governor General in the Public Works Department, Rajputana and Central India.

With reference to correspondence ending with your letter No. 2201, dated the 14th June 1901, I have the honour to forward two printed reports with maps on the Irrigation Works of the Kotah and Jhalawar States for the year ending December 31st, 1900, with suggestions for future irrigation works as an insurance against famine, prepared by Mr. R. H. Tickell, State Engineer, Kotah, and Jhalawar, together with copies of the margiually noted forwarding letters from the Diwans of Kotah and Jhalawar.

No. 134, dated 16th September 1901, from the Diwan of Kotah, with enclosure.
No. 213, dated 22 d September, from the Diwan of Jhalawar, with enclosure.

2. It will be seen that the Diwan of Kotah is doubtful whether Mr. Tickell's proposed new works will in every case meet the success Mr. Tickell anticipates. However, the thorough local enquiry by an expert, which the Diwan desires should settle this point, and for the next few years there are certainly a sufficient number of projects among the many proposed new works which will be not only an insurance against famine in years of drought, but will also yield a substantial profit in years of normal rainfall.

3. A translation of the Urdu Note by the Revenue Superintendent of Kotah is not forwarded as his main contentions are summed up in paragraphs 4 and 5 of the Diwan's letter. The result of his experience, which demands consideration, is that a profit of more than 3 per cent. cannot be expected from the proposed new works and he is strongly in favour of a greater extension of small works such as wells and tanks. He adds that Mr. Tickell has been wrongly informed that the existing irrigation works are only used for kharif crops, and gives figures to show that the reverse is the case.

No. 134, dated the 16th September 1901.

From—The Diwan, Kotah State,

To—The Political Agent, Kotah.

I am to acknowledge receipt of your letter No. 200-C., of the 8th June 1901, forwarding copy of letter No. 1499-C., dated 24th of April, from the Secretary to the Honourable the Agent to the Governor General, together with its enclosures.

2. In reply I am to submit the preliminary information for famine irrigation programme, together with a map of the country, required by the Honourable the Agent to the Governor General, and collected and compiled by Mr R. H. Tickell, the State Engineer. The Durbar cordially desire to co-operate with the Government of India in their most admirable and statesman-like policy. They can quite appreciate the advantages pointed out of having such a programme of famine protective works ready to be taken up in the event of future famines. But in this connection I am to forward a Note written in Urdu by the Revenue Superintendent of the State showing in detail the general unsuitability of the soil of the country to irrigation, and to ask that before this programme is finally accepted and passed, a more thorough local inquiry may be made by an expert respecting the nature of the soil, which it is proposed to irrigate from the works suggested.

Letter No 244, dated the 22nd August 1901, from the State Engineer.

3. Past experience shows—

(i) that the land of the country—generally black cotton soil—does not want irrigation except for poppy;

(ii) that the poppy crop though valuable is very expensive and exacts more labour and care than other crops, hence its expansion is limited by the general ability and agricultural resources of the cultivator; and

(iii) that area under poppy does not exceed 5 per cent. of the total cultivated area.

A landholder of 80 or 100 bighas has seldom more than 5 bighas under poppy, the rest of his land being devoted to *juar, tilli* and cotton in the kharif and to wheat, gram, and linseed in the rabi.

4. To grow wheat—the staple produce of Kotah, land here, unlike land in other parts of India, does not require irrigation. In fact it suffers from it, as also from any excess in the year's rainfall. So that whatever value the proposed large irrigation works might have in times of famine, in ordinary years they would yield but little profit.

5. Such being the result of past experience the Durbar think that only such of the works herewith suggested, or that may hereafter be proposed, should be marked down for construction as may be, not only an insurance against famine in years of drought, but which will also yield a reasonable income in ordinary years.

6. We are further considering what other works, besides irrigation works, can be suggested as famine protective works to be included in the programme and may be able to make a further communication later on.

No. 244, dated the 22nd August 1901.

From—The State Engineer, Kotah State,

To—The Diwan, Kotah.

In reply to your No. 917 of 1900-1901, dated 15th June 1901, forwarding in original No. 200 C, from the Political Agent, Kotah and Jhalawar, in which copy of letter No. 1499 S., dated 24th April 1901, from the Secretary to the Honurable the Agent to the Governor General for Rajputana was enclosed, conveying orders for the preparation and submission of a report on the irrigation works of the Kotah State with investigation for irrigation projects as a protection against famine, I have the honour to submit herewith four copies of the report called for each accompanied with two plans. I would suggest that the two reports accompanied by tracings should be submitted to the Secretary to the Honourable the Agent to the Governor General as the tracings illustrate the report more clearly than the ferrotypes, and that the two other reports with their ferrotype plans be kept for record, one in your office and one in that of the Political Agent's office. The ferrotypes can be replaced by tracings hereafter if asked for.

2. I should like to call the special attention of His Highness the Maharao to the following facts which have been noted in the report:—

(*a*) The State has over 300 small tanks from which practically no irrigation is done, as all the tanks have a drainage area of less than 3 square miles. In addition there are 16 ancient tanks described in Appendix B of the report from which the irrigation is not a success owing to the fact that only six tanks out of the 16 have a drainage area of more than 3 square miles.

All the above-mentioned tanks were constructed without the assistance of professional advice or supervsion.

(*b*) The state has five modern irrigation works (Appendix C) constructed in the last 23 years under professional advice and supervision, and they pay off an average 4½ per cent. The

drainage areas of these tanks are as follows—2 of over 3,000 square miles, one of 200 square miles, one of 81 square miles and one of two square miles (the last is an ancient tank restored and enlarged). These five modern tanks amply prove that it is only tanks of large drainage areas that are remunerative.

(c) There are now seven important irrigation works in progress (Appendix D) which have drainage areas varying from 4½ to 198 square miles.

(d) There are sixty-seven new works proposed (Appendix E) in all of which it will be noticed that large profits are anticipated and in all cases large drainage areas are considered a *sine qua non*.

3. Among the 67 new works proposed in Appendix E the most promising as protective works in famine years are the following, which are now noted in order of importance :—

Order in Importance.	Serial No. in appendix.	Index No. in map.	Name of works.	Catchment area in sqr. miles.	Estimated cost.	No. of villages to be protected.
1	54	67	Ujjar Baran Tank .	50	1,60,000	17
2	43	56	Kali Sindh canal .	3,300	3,00,000	22
3	19	26	Parbati canal tank .	3,328	3,00,000	32
4	28	36	Suragar Raipur tank	57	75,000	9
5	44	57	Mao Ujjar Tank .	100	2,50,000	22
6	45	58	Parwan Tank: Shergarh	1,300	3,00,000	24
7	52	65	Ghur taraj Tank:	320	2,10,000	17
8	53	71	Dilunpur tank .	160	1,50,000	18
			TOTAL .		17,75,000	181

The reasons why these works are selected for particular notice are—each tank has a large drainage area and thus will fill in all years with absolute certainty and so act as a perfectly safe insurance against famine; and each tank protects a large number of villages.

Of the above-mentioned works detailed projects are being prepared for the first four and will be ready in a few months. The rest will be taken up when survey establishment is available.

Any of these projects can be confidently recommended should His Highness care to commence work on them by means of loans from the Famine Insurance Fund of the Imperial Government.

4. In your No. 1015, of the 16th July, you forwarded copy of letter No. 278 C., dated 1st July 1901, from the Political Agent, Kotah, in which a Memorandum prepared by Mr. T. Higham, C. I. E., Inspector General of Irrigation, was forwarded for guidance of officers engaged in enquiries relating to famine protection works. In this Memorandum I find some information is called for, which I have found it impossible to supply. Thus in paragraph 2, B C D E F G H all the information asked for cannot be given in full detail for the reason that to supply such information the following records should have been kept at each irrigation tank in the State.—Daily gauge readings of the water level in each tank, a table showing volumes of water in each tank corresponding to each gauge reading, gauge readings of water level in each canal, discharge tables for each level for each canal, monthly record of areas and description or fields irrigated. Such records for each tank have never been kept, the system in Kotah being that whenever a tank is completed it is handed over to the Revenue Department, and the distribution of water and collection of revenue is entirely in the hands of the Revenue Department. Again, in the case of old tanks the advantage due to irrigation is included in the land revenue and no separate taxes are levied. All that I have found it possible to report is the total volume of water stored in certain tanks, and the average irrigated areas and average revenue for 6 years ending July 1899.

Again in paragraph 4 of Mr. Higham's memorandum information is called for with regard to *proposed works* which, in the present report it is not possible to supply as so many works (67 in number) are proposed. In paragraph 3 of this letter I have described eight of the most important famine protective works, and in preparing the detailed plans and estimates for those works I will give full attention to all the items required to be reported on by Mr. Higham. *Mr. Tickell.* 22 Nov. 01.

5. Accompanying your No. 1015, of the 16th July 1901 is a Memorandum showing that the reports on famine irrigation works should be divided into three parts, and information supplied in a certain order.

I regret that the present report prepared by me is not exactly on the lines laid down, having been completed and printed before the latest orders on the subject were received, but it is very nearly in the form required, the only difference being that I have divided "Existing works" into two Appendices B and C "New works" are shown in Appendix D—and "new proposals" are shown in Appendix E. The only question not reported on is "benefits derived during 1900-1901 from any tanks constructed as relief works during the late famine," and in reply to this it may be noted that no benefits have yet accrued as all the famine works (tanks) are either incomplete or have only just been completed and irrigation has not yet been started.

No. 243, dated the 22nd September 1901.

From—The Diwan, Jhalawar State,

To—The Political Agent, Kotah and Jhalawar.

With reference to your letter No. 201 C., of the 8th June last, and subsequent reminder regarding the Famine Irrigation Programme, I have the honour to submit herewith a copy of Mr. Tickell's * report on the subject, which gives all the information required.

* With forwarding letter No. 401, dated 3rd September 1901.

2 I may add that of the four tanks, (1. Stratton Sagar, 2. Kishanpura Tank, 3. Mundliakheri Tank, and 4. Hatunia Tank) which were commenced as Famine Works, the first two were practically completed before the rains, and what little remains to be done will not take long now. As regards the Kishanpura Tank I am glad to say that it could successfully stand unusually heavy rainfall of the 14th August, when we had more than 8 inches of rain during 24 hours. As regards the remaining two tanks, *viz*., the Mundliakheri and the Hatunia Tanks, the work will be recommenced as soon as the rainy season is at an end.

No. 401, dated the 3rd September 1901.

From—R. H. Tickell, Esq., C. E., State Engineer, Kotah and Jhalawar State,

To—Rai Bahadur Pandit Parmanand Chaturvedi, Diwan, Jhalawar State.

With reference to your No. 63, dated June 22nd, 1901, I have the honour to submit herewith a Report on the Irrigation Works of the Jhalawar State for the year ending December 31st, 1900—Sambat 1957.

2. I should like to call the attention of His Highness the Raj Rana to the fact that though the State is said to have about 120 ancient tanks, only about 6 of them are worth improving, owing to the fact that all these tanks are placed with drainage areas of less than three square miles.

3. In Appendix D of the Report the four tanks commenced during the famine are described. It will be seen that the drainage areas of these tanks are—25, 21, 3½ square miles and in the case of the Stratton Tank, 1¼ square miles. Three out of four have comparatively large drainage areas, and in the case of the fourth, the Stratton Tank, the small drainage area is compensated for by the fact that it is placed below the Gaonri Tank and so benefits by percolation and excess discharges from the waste weirs of the Gaonri Tank. I would strongly recommend His Highness to complete these four tanks without further delay, as unfinished tanks are always liable to be breached, unless careful precautions are taken.

4. In Appendix E a programme for future Irrigation Works is suggested. It will be noticed in these works large drainage areas are almost invariably considered necessary.

Mr. Tickell.

22 Nov. 01.

The works which are of most importance as Famine Insurance Works are as follows :—

Order in Importance.	Index number in Appendices.	Index number in Map.	Name of Work.	Catchment area in square miles.	Estimated cost.	Number of villages to be irrigated.
1	D 2	7	Stratton Tank .	1¼	12,000	1
2	D 3	6	Kishanpura Tank .	3½	25,000	2
3	D 4	14	Hatunia Tank .	21	13,000	3
4	D 1	8	Mundliakheri Tank	25	65,000	6
5	E 6	15	Pachpahar Tank .	20	60,000	5
6	E 4	13	Rewa River Tank	70	90,000	9
7	E 20	29	Kalisindh River Bund . . .	900	1,50,000	9
			Total .		4,15,000	35
			Expended already up to December 31st, 1900 .		57,000	
			Balance to be expended. .		3,58,000	

The reasons why these works have been selected as the most important are that the first four are from half to three-fourths completed, and the rest are Irrigation Works on large rivers, and so will certainly supply water in famine years.

5. In the orders on the subject of the preparation of this Irrigation Report Mr. T. Higham, C.I.E., Inspector-General of Irrigation, has written a Memorandum asking for certain information relating to duty and revenue of water, and this I find it impossible to supply owing to the fact that it is the custom in the State to hand over all Irrigation Works when completed to the Revenue Department; and no gauge registers of tanks or canals are kept, and water-rates are not charged separately, but are included in land revenue. In making estimates of the projects on Irrigation Works I have followed the rules adopted by my predecessor, Mr. Miles (which I believe, is also the rule in the Jaipur State), of taking a net profit of Rs. 2 per bigha, and have assumed that 100,000 cubic feet of water is required to irrigate one acre of land (one acre being = 2½ bighas).

6. On the 16th July 1901, I find orders were received from the Secretary to the Agent to the Governor General, in the Public Works Department, in which it was requested that this Report should be divided into three parts, and information supplied in certain order.

I regret that the present report prepared by me is not exactly in the form ordered, having been completed and printed before the latest orders on the subject were received, but the report is so very nearly in the form required that I did not think it necessary to re-write and reprint the Report.

In conclusion, it should be noted that up to the present no benefits have accrued from any of the tanks commenced during the late famine as all are in an incomplete state.

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1. Q. (*President*)—You are State Engineer of Kotah?—Yes, and also Advising Engineer to Jhalawar.

2. Q. Have you been long in Kotah?—Six years.

3. Q. You know the country—You have been there through the famines?—Yes.

4. Q. Kotah was rather hard hit?—Yes; very hard; thy lost 24 per cent. of the population.

5. Q. Apparently the Kotah people have never paid any serious attention to tank irrigation?—They have made a large number of small tanks (about 400), but they don't pay, and in the last 20 years they have made five important irrigation works which give very fair results.

6. Q. Were the small tanks made for irrigation purposes or for watering cattle?—They were started with the idea of doing irrigation, but they have not been used for that purpose. Their beds are cultivated.

7. Q. I see that in spite of your two famines you have an average rainfall in six years of 32·9 inches?—Yes, we have had it as low as 15 inches. In two districts we had it as low as 15 inches and our maximum is 57 inches. In the southern part of the State the rainfall is heavy.

8. Q. Last year you had very good rainfall?—Yes, very good.

9. Q. You will have no distress?—I don't think we will have any.

10 Q. I see from your figures that in 1900 you had a rainfall of 43·5 inches. You don't give figures for 1901?—No. I have not got those figures but we have had a rainfall below the average this year.

11. Q. I suppose a good many of the works given in Appendix E of your memorandum are looked upon as famine relief works?—I should say they would be all profitable works and useful as famine relief.

12. Q. You think the works come into the category of famine works. Are they works worthy of being made at once or should they be reserved for future famine?—I think they should be taken up gradually, and as the State goes on constructing they can see for themselves whether they are profitable or not.

13. Q. I think you have only one river project?—There are several river projects but they all include storage tanks.

14 Q. Are the Durbar inclined to go on with the works you specify?—They have approved of works costing about ten lakhs out of 44 lakhs suggested, but they have not said anything about how long they are going to be in constructing them.

15. Q. Have you any works in hand?—Yes; they are shown in Appendix D of my report.

16. Q. There is, you think, considerable scope for storing water in Kotah?—Yes, there are four large rivers with many tributaries having large catchments.

17. Q. Had you extensive relief works going on last famine?—Yes, we spent about 9½ lakhs altogether; on Public Works only 2½ lakhs; about Rs. 1,63,000 were given in takavi advances; in gratuitous relief Rs. 1,48,000; for seed Rs 2,28,000; and from the charitable relief fund Rs. 1,45,000. We made 34 miles of railway and constructed 54 small tanks.

18. Q. In spite of all that you had a high death-rate?—Yes, we lost 24 per cent. of our population.

19. Q. To pass on to Jhalawar, you propose there a number of tanks?—All these tanks have been approved by the Durbar.

20. Q. None of them have been actually begun?—The works in progress are shown on Appendix D.

21. Q. Is there much well irrigation in the State?—A great deal and also a certain amount of irrigation done by taking off channels from flowing rivers to depressions in low-lying lands.

22. Q. Are the people in the habit of putting bunds along the lower sides of fields so as to stop the water from flowing off?—Yes, I have seen some works of that sort but they are not in use. The slopes are rather steep, I think that is the reason.

23. Q. Jhalawar suffered very much in the famine?—Yes, they lost 36 per cent. of the population.

24. Q. (*Mr. Higham.*)—What is the Kotah bigha?—2½ bighas go to an acre. It varies slightly in different parts.

25. Q. A bigha is four-ninths of an acre?—Yes.

26. Q. (*Mr. Ibbetson.*)—The same as in Jhalawar?—Yes.

27. Q. (*Mr. Higham.*)—These works in Appendix C that have been constructed. Have you constructed any of them yourself?—No. They were all done by my predecessor.

28. Q. Who was that?—Mr. Miles.

29 Q. He made them all?—Yes.

30. Q. You give in Appendix C a Statement of actual cost. What does that represent?—That is the total cost of the work.

31. Q. Of original construction?—Yes.

32. Q. Are annual charges for repairs included?—No, they are charged to the profits. The net profits are about Rs. 15,000 a year.

33. Q. What is the average cost of maintenance?—About Rs. 6,000 a year.

34. Q. For each work?—No, for five works.

35. Q. What does it include?—Whatever repairs have to be done.

36. Q. I suppose there is a supervising establishment?—Yes, when we make an estimate for repairs the establishment is included in the estimate of repairs. The zilladar has a very small staff.

37. Q. Is that charged against the works or the revenue?—I think against the works.

38. Q. Does this figure of capital cost include establishment?—Yes, all our estimates include establishment.

39. Q. It does not include the State Engineer? It does not now, but it used to. It used to include a share of the Engineering establishment.

40. Q. You think this actual cost may be taken as representing roughly what the future works will cost?—I think so, but some of the works can be constructed cheaper. For instance some of these works cost Rs. 28 per acre irrigated to construct, but some of our schemes will run to Rs 15 an acre only.

41. Q. Your average area irrigated for the last six years includes dry years?—Yes, there was only one very dry year with only 15" of rain.

42. Q. These five works you estimate will irrigate 20,000 bighas?—The irrigation varies from 12,700 to 5,600 acres per annum. But many of the tanks have rather a low duty, only four acres per million cubic feet. In the famine year the area irrigated was ten acres per million cubic feet which shows that irrigation can be extended when properly managed.

43. Q. I want the actual cost in terms of acres of all these works; if these figures are correct it works out to Rs. 50 an acre?—I suppose it would be that but three of the canals take off from rivers and irrigate in the kharif only.

44. Q. What do you consider when working out a project for a tank a fair rate to allow for the capital cost on the acreage you are going to irrigate. What is the rate that will be remunerative?—Rs. 15 is bound to be remunerative and you can go up to Rs. 30 or Rs. 40 an acre. The produce of one year's irrigation is practically equal to the cost of the work.

45. Q. If a tank is likely to cost Rs. 100 an acre would it be worth while constructing? No, I should say not; because we can make plenty, such as I have suggested, at Rs. 30 to Rs. 40 an acre.

46. Q. What limit of cost would be considered desirable?—Rs. 15 would pay handsomely and Rs. 30 would pay in a famine year.

47. Q. You think Rs. 50 is not extravagant?—I think it is.

48. Q. In Jaipur they regard Rs. 50 as a promising rate?—In the north of the Jaipur State irrigation is more important than in Kotah. There is less rainfall there.

49. Q. What revenue would you get? Are there such things as water rates?—Yes, the water rate is Rs. 1-8 an acre on an average. It is much lower than in any other part of India that I know of.

50. Q. In your figures of revenue do you include land revenue?—Yes, we do include it, otherwise the water rates are so low the works would not pay. The water rates should be low because the land assessment is very high. It is only fair that a certain proportion should be included under tanks.

51. Q. How are these figures made up?—I don't know anything about them. They were given to me by the Revenue Department.

52. Q. The difficulty is we don't know what they do or do not include. Are they taken from the annual report?—Yes; from the annual administration report.

53. Q. With respect to the new works you have in Appendix E, I suppose some of these are certain to be highly profitable?—I think so, absolutely certain.

54. Q. Many of these works might very well be constructed as profitable investments without consideration of protection against famine?—Yes, some of them. When you have masonry work they are no good as famine relief works.

55. Q. Do you think any of these works would be a good financial investment?—I think so, the Bára-Ujar tank for instance which works out to Rs. 15 an acre.

56. Q. You say the State have already approved of about 10 lakhs worth?—I think if they go on with 10 lakhs and see results they will probably go on right through the scheme. *Mr. Tickell.* 22 Nov. 01.

57. Q. Which are the particular works they have approved?—In Appendix E they have approved items Nos. 8, 9, 12, 13, 15, 16, 17, 39, 42, 43, 44, 45, 54. Annasagar Feeder, Shahabad-Sarun, Khatka Tank, Sokel Tank, Kheria Tank, Nahargarh Tank, Simlod Tank, Salera Tank, Autralia Tank, Kali Sind Canal, Mao Ujar Tank, Perwan Tank, Shergarh, Ujar-Bara Tank. Four of these are works I particularly recommended to them.

58. Q. You recommended they should begin on the most promising works?—Yes, that is what I want them to do.

59. Q. The whole programme would be available for famine relief?—There are such a number of them; I could not get ready more than twelve projects a year.

60 Q. These would be available for famine relief if famine came?—Some of them; the earthen bunds, not the masonry.

61. Q Did you employ relief labour on tanks?—Yes, on seven of them that are now in progress.

62. Q. What about completing the works now in progress?—The Umed Sagar Tank will be completed.

63. Q The others are waiting for funds?—Many of the tanks are to be carried out as small schemes instead of as first recommended and when they have been cut down to small schemes I don't think they will pay. If extended they undoubtedly will pay.

64. Q. Is it proposed to go on with them now?—I think the State is rather hard up.

65. Q. As far as you have gone do you think they will do any good?—No I don't think they will. They are such small tanks; they only hold about 20 million cubic feet. The water is too precious to be used for irrigation and the people would prefer to use it for domestic purposes.

66. Q. The Durbar have not sanctioned any particular rate of expenditure I suppose?—No, they have not.

67. Q. What do you suppose they will allow you to spend?—In the last 20 years they have spent 13 lakhs on so called irrigation works, such as wells and small bunds which are not really irrigation works.

68. Q. They have allowed about one lakh a year?—About three-fourths of a lakh for irrigation.

69 Q. I suppose that No. 19 on your list is too big a work for them?—I think so. Before that is taken up they should improve the aqueducts. Many of the aqueducts at the heads of the canals leak badly and should be rebuilt.

70. Q. In Jhalawar does the State propose to construct any works?—Yes, they have four works on hand. Two are completed and two they say they will complete.

71 Q. These works were completed in the famine?—Yes.

72. Q. What are the new works you propose?—Twenty-three new works shown on Appendix E. They have not yet taken up the new works, but I believe they will as the Dewan is rather keen on irrigation.

73 Q. Is the State keen on irrigating *jagir* lands?—Yes, they look on *jagir* land as part of their own property. Generally they can be resumed by the State.

74 Q. What do you get from the *jagir* land; a water rate?—Yes; in the Kotah State from new Irrigation Works. In the case of old Irrigation Works the water rate is included in the land revenue.

75. Q. (*The President.*)—Have you any statistics of *jagir* lands?—No, it is difficult to get statistics of them.

76 Q. (*Mr. Rajaratna Mdlr*)—You don't know how the Revenue officials calculate the profit due to irrigation?—They calculate according to their own discretion I believe. If they consider that the land revenue should be included in tank profits they include it I don't think they always include land revenue, but on old tanks the water benefit is included in the land assessment. It is only on new tanks that they charge water rates which are so low that they often credit the whole land revenue to irrigation.

77. Q. Have you taken account of the interest in calculating the profit on the capital outlay?—No.

78. Q. Should you not as a professional Engineer allow for the interest?—You might just as well charge interest on all the forts they construct to render the State more secure.

79. Q. That is a different matter; should you not take into account a reasonable rate of interest on which they can

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borrow from Government?—If they borrow the money then you must consider the interest. I think if they were to borrow it would be a good thing; then they would only take up paying projects.

80 Q. You speak of net revenue for six years, what does the "net revenue" mean?—That means the revenue *minus* the cost of maintenance. Very often you have a year of *minus* profits.

81. Q. (*Mr. Ibbetson.*)—You cannot tell us how the credits on existing works are calculated, but will you tell us how you get at the revenue you anticipate on your schemes?—We usually take an all round rate of Rs. 5 an acre as the benefit from the tank.

82. Q. That is a rough approximation?—Yes. The water rate is only Rs. 1-8 an acre but tanks would bring new land under cultivation from which the State formerly got no revenue. In such a case it is perfectly fair that the land revenue and water rate should be a credit to the work, but in the case of old land being brought under cultivation it does not seem altogether fair.

83. Q. To what area do you apply that Rs. 5?—I think it is usually taken for the whole area?

84. Q. What "whole" area?—The area likely to be brought under cultivation In getting out detailed projects I only take one rupee per bigha which comes to Rs. 2-12 per acre. I take that because I think it is better for the State to anticipate low profits.

85. Q. That is the basis of each of your schemes here?—Yes.

86. Q. I have not yet got what I want; there are two rates which you apply to the area to be actually cultivated. Do you include the bed area in the irrigated area?—No.

87. Q. In some cases there is a considerable area that is left out?—Yes.

88. Q. Do you make any allowance for improvement of the supply in wells adjoining the tank?—No.

89 Q. So that on the whole you think that the revenues shown in the statement of existing works and in the statement of proposed works are a good deal under the mark, because the bed areas and the wells are both left out of consideration?—I think Rs. 5 an acre is a fair rate to take.

90. Q. For irrigation?—Yes.

91 Q. Then you have two items more, bed area and the improvement of wells?—I think that would include every thing.

92. Q. Are your rates high enough to cover that?—I think it would cover it.

93. Q. At the same time in the statement of works completed the net revenue shown is rather below the mark?—Yes, I think it is below the mark.

94. Q. It does not include bed area and it does not include anything for wells?—No, it does not.

95. Q. You say that small works won't pay. Is that because the water is taken for domestic purposes?—I think that is one reason. For the last 200 years the State have been constructing these small works and they never show any profit.

96. Q. Why should not the small tanks pay even if they don't irrigate?—Because small tanks are reserved for domestic purposes and for watering cattle. Water used for such purposes is more valuable than water used for irrigation, and small tanks sometimes dry in three months without having been used for irrigation. I think the bed area should be included in irrigation profits when it is cultivated. These small works don't pay—it is difficult to estimate the profits. Because all these small tanks are old tanks and the land revenue has been assessed to include the water benefit. The water benefit seems to increase the value of land 200 to 400 per cent.

97. Q. Do you mean that these small tanks don't appear to pay according to figures or do you mean they really don't pay for their construction?—I don't think they pay because the State might for the same expenditure have made paying projects. I mean the money could have been more profitably spent on larger works.

98. Q. We have been told in several places that a great deal of money has been wasted because the tanks have been built without professional skill and therefore they are not used to their best advantage. Do you think that is the case in Kotah?—Yes. I think that about 95 per cent. of the old tanks are badly situated. They are often designed for much more water than they could possibly get.

99. Q. So that had they been constructed with expert advice they might have paid?—Yes, I think so undoubtedly.

100. Q. My point is, is there any inherent reason why small tanks should not be profitable?—No, provided they are large enough to irrigate from. I think a moderately small tank is the most profitable. The most paying tank in the State holds 50 million cubic feet. The villagers do their own distributing. I think generally speaking the most paying tank is from one hundred to five hundred million cubic feet.

101. Q. You told us that out of the famine expenditure on the last famine 1¼ lakhs were given in takavi. What was the takavi given for?—I think for well construction.

102. Q. A very small proportion of the famine expenditure was expended on irrigation works; why was that?—The State knew that by spending money on the railways they would get a return and they spent a large amount on the railway. They in fact transferred their famine relief to the railway for whom they were doing the work.

103. Q. They preferred that to the tanks?—They preferred it because they were getting their money back.

104. Q. You mean the railway would pay them?—Yes. Repay them their capital.

105. Q. (*The President.*)—Can you tell us how much of the 2½ lakhs on Public Works went on irrigation works?—I think about Rs. 80,000 was spent in Kotah on irrigation works and village improvements. In Jhalawar the whole expenditure was on irrigation works.

106. Q. (*Mr. Ibbetson.*)—Was the small expenditure in Kotah due to schemes not being ready?—Many of the irrigation works are really only village improvements.

107. Q. But had you projects ready that you could have used your labour on?—No, we only had one big project ready.

108. Q. Absence of projects was not the reason? You could have used the labour on irrigation works easily?—Yes.

109. Q. You say that your professionally made tanks ordinarily irrigate four acres per million cubic feet—in a famine year ten acres. How far did the area shrink in the famine year?—The irrigated area of tanks expanded in the famine year. We had the usual amount of water in our irrigation tanks. The canals from the river did not do so well as usual. In the famine year the area irrigated was 6,551 acres. From the tanks the area was the largest recorded.

110. Q. On the canals was there much shrinkage?—Yes; the Parbati canal irrigated only half the usual area; the Ramgarh a little more.

111. Q. Can you give the figures?—The largest irrigated area in 1897 was 12,774 acres and the irrigated area in the famine year 6,550 acres. The shrinkage was entirely due to the river.

112. Q. Why do you say in face of these figures that a tank which costs Rs. 50 will not pay always while a tank which cost Rs. 30 will pay in a famine year?—We double our duty in a famine year.

113. Q. If you double your duty and get half the supply of water you still get a diminished area?—If your catchment is large compared to the size of tank you may have a full tank in a famine year and irrigate as much or more than usual.

114. Q. You mean you get such a large catchment that the supply, even though short, would be sufficient to supply your tank?—You wouldn't irrigate the full area if you stored every foot of water that fell on a catchment, because in a famine year the rainfall would be deficient; but all tanks allow excess rainfall to flow off, and so in a famine year a good tank would not be so very deficient in its supply.

115. Q. (*The President.*)—Will a higher duty be got out of the water in a famine year?—Yes, I think the management is more careful in a famine year.

116. Q. (*Mr. Ibbetson.*)—I am not sure that I followed you about *jagir* lands which you said could be taken back. Do you mean to say that if the State constructed a tank on *jagir* lands it would resume those lands and give *jagir* elsewhere instead?—No, I believe the State can withdraw *jagir* land. The *jagir* villages are not considered.

117. Q. Do they never say to a *jagirdar* "here is water available if you give us something more than a share of the water rate"?—No, they never do that, many *jagirdars* make their own tanks.

118. *Q.* Is there much done in the way of bunds by the people themselves?—No; no work is ever done in a Native State except by State aid.

119. *Q.* You don't think embankment of fields on a large scale is possible?—No; the slopes are too irregular.

120. *Q.* You would have to terrace?—Yes, with masonry works.

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WITNESS No. 13.—MR. ASHTON, Deputy Commissioner, Salt Department, Ajmer.

Witness put in the following documents:—

1. Memorandum showing grounds how the construction of Irrigation Works will affect the salt manufacture in Rajputana (printed below).

2. Statement showing the rainfall flow of the feeder streams and depth and density of the brine in the Sambhar Lake.

Memorandum of the evidence which Mr. F. Ashton is prepared to give showing the grounds upon which the Northern India Salt Revenue Department objects to the construction of irrigation works or reservoirs which may obstruct the flow of water in the Rupnagar Nadi and other streams that enter the Sambhar Salt Lake in Rajputana.

1. The department has been in charge of the Sambhar Salt Lake since 1870, a period of 31 years; and it may, therefore, reasonably be held to have had sufficient experience of local conditions to give its opinion, with regard to the requirements of salt manufacture, considerable weight.

2. The manufacture of salt at the lake depends upon the quantity of water which enters it during the monsoon rainfall by the streams which carry into it the drainage of the surrounding country. These streams are in flow only during the monsoon; at other seasons of the year they are dry.

3. The water which enters the Lake during the monsoon takes up salt in solution from the saline matter in the Lake bed, and salt is manufactured from the brine so formed. Except during years of very heavy rainfall over the catchment areas of the feeder streams, the brine of the Lake disappears by evaporation during the dry season which follow a monsoon, and the occasions on which water has remained in the Lake throughout the year have been rare.

4. The bed of the Lake is singularly level; it has been calculated that its fall from the edge towards the centre is only about two feet in three miles. The area of the Lake is large, about 90 square miles; but as the region in which it is situated is dry and the rainfall precarious, the quantity of water which accumulates annually is limited, and is shallow when spread over such a large surface.

5. The mud of the bed is every where deep and adhesive, and factories for the manufacture of salt have consequently to be constructed as near as possible to the edge of the Lake. The shallow sheet of water is much influenced by strong winds, and may be driven away from the salt works or banked up against them; evaporation is rapid in the dry climate of Rajputana; and the manufacture of salt has to be carried on with expedition, in order to utilise as much brine as possible before it disappears by evaporation.

6. From these considerations, it will be seen that in salt manufacturing operations, dependence has to be placed upon the annual accumulation of water in the Lake; there is no reserve of brine. Floods have occasionally occurred, but the chief difficulty with which the Department has to contend in manufacturing salt at the Lake in the dry climate of Rajputana is the inadequacy of the water-supply. And as the shallow sheet of water is readily driven from west to east or from east to west according to the prevailing direction of the wind, a comparatively small increase or decrease in its quantity may have a great effect on the quantity and quality of salt manufactured in any particular season. It is, therefore, a matter of vital importance to the Department that no check should be placed upon the flow of water into the Lake by its feeder streams during the monsoon period.

7. The principal feeders of the Sambhar Lake are the Rupnagar Nadi and the Mendha River, which enter it from the south-west and north-east respectively. The former with its branches flows through the Ajmer District and the Kishengarh State, one branch taking its rise in Jodhpur; while the course of the latter traverses the territory of the Jaipur and Jodhpur States.

8. The catchment area of the Rupnagar Nadi is about 241 square miles, a considerable part of it being rocky and hilly with much drainage capacity. The catchment area of the Mendha river is about 1,400 square miles of level sandy country.

9. Of the two streams, the Rupnagar Nadi is more to be depended upon to give an annual supply of water to the Lake, owing to the hilly nature of the country and its capacity for drainage; while the country traversed by the Mendha requires considerable rainfall upon it for that river to come down in flood. It is therefore of vital importance to the Department that the flow of the Rupnagar Nadi should not be impeded and the value of the stream is particularly great in years of short rainfall.

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10. The Mendha river is not adapted to the construction of dams across its bed, and it is believed that there is not at present any proposal under consideration for the construction of any new irrigation works of importance upon the river or its tributaries. It is, therefore, not proposed to add to the length of this Memorandum by discussing the question of the supply received from any stream but the Rupnagar. But it is essential to salt manufacture that the water which the Mendha River and the minor feeder streams give to the Lake should not be diminished; and the absence of reference to the subject should not be understood to mean that the department waives its right to object to the construction of the Mendha or of any other stream which enters the Lake.

11. The upper portions of the Rupnagar Nadi and its tributaries are adapted to the construction of tanks and reservoirs, and the stream is in consequence already heavily obstructed.

12. The Department first became aware of these obstructions in 1900. At the commencement of that year, enquiry was made by the Kishengarh Darbar as to whether the Department would object to the construction of a dam across the bed of the Rupnagar Nadi at Salemabad in Kishengarh territory. It was stated at the same time that the Darbar was compelled to consider the question of the construction of this dam, in order to keep up the water level in wells, which would be affected by the completion of a dam higher up the river at Ontra in the Ajmer district. The whole matter of obstructions on the feeder streams of the Lake and their tributaries was then enquired into, and considered by the Government of India in the Departments of Finance and Commerce and Public Works.

13 It is understood that the Ontra dam was not undertaken as a remunerative work, but as a famine relief scheme. The estimated cost of the dam was Rs. 1,56,145, and the storage capacity of the reservoir that would be formed was estimated at 77 million cubic feet of water. The maximum revenue which was estimated as obtainable from irrigation was Rs. 3,000 a year; in ordinary years the return would probably have been considerably less. As the reservoir was only expected to fill in particularly good years of rainfall, the dam would have completely obstructed the river in ordinary years, when the downward flow of water would have been of the greatest value to the Lake. On a consideration of the circumstances, connected with this dam, the Government of India directed the cessation of its construction and the removal of obstruction to the waterway. (See letter No. 1875 S.R., dated the 17th April 1900, from the Department of Finance and Commerce, to the Commissioner of Northern India Salt Revenue, copy appended.) The dam at Salemabad in Kishengarh territory alluded to in the preceding paragraph, has not been constructed. The Minister of the Kishengarh State informed the Assistant Commissioner of Sambhar in February 1900, in reply to a demi-official letter of enquiry, that His Highness the Raja would consent to abandon the Salemabad project, "if the flow of the river were left uninterrupted."

14. Following the question of the Ontra dam, an investigation with regard to the obstructions on the Rupnagar Nadi and its branches was undertaken by the Department, and the dams and tanks noted in the list appended were found to exist. In all, there are 37 reservoirs and tanks of greater and lesser importance on the Nadi and its branches, and of these 13 appear to have been constructed or enlarged since the Department has had charge of the Lake and without notice being given to it. A scrutiny of the list will show that there has been great activity in construction during the past two years; not only have new obstructions been built, but old ones have been repaired and strengthened.

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15. The most important of the tanks or reservoirs are those at Kuchil in the Kishengarh State, and at Kair, Ararka and Gowanri in the Ajmer District.

The Kuchil Tank is an old one, but it was strengthened and repaired during 1899, and a dam was constructed across the bed of the stream to divert water into the tank. An overflow tank was at the same time constructed. The dam was carried away in the monsoon of 1900. Revenue statistics in connection with irrigation from the tanks are not available.

The dam at Kair was constructed in 1891-92 at a cost of Rs. 2,68,891, and the area annually irrigated from or beneficially affected by it has, down to the present, been less than 40 acres with an average assessed revenue of Rs. 124 a year. The dam has doubtless helped to raise the water level of wells in its vicinity, but as a productive public work it appears to have been an utter failure. The good which the reservoir may have done locally appears to be incommensurate with the expenditure, to say nothing of the injury caused to the Lake by its construction.

The Ararka Tank is an old one, but the dam across the stream which diverts water to the tank was, it is understood, raised in 1891-92 and was further strengthened in 1899. Here also the area irrigated and the revenue assessed are trifling; acres 34 and Rs. 81 in the only year for which statistics have been supplied to the Department.

The Gowanri reservoir was constructed in 1876-77 and is, therefore, of long standing. It intercepts the whole of the water entering the Ontra branch of the Rupnagar stream above the dam forming the reservoir.

16. The storage capacity of all of the reservoirs and tanks on the Rupnagar Nadi and its branches is not known, but the quantity of water held up by them is believed to be very large, and the effect upon the water-supply of the Lake serious. The view of the Department is that water passing from the catchment area into the upper branches of the Rupnagar and its tributaries will, even in seasons of short or partial rainfall, either reach the Lake, or assist water entering the stream lower down to do so. This view has been controverted. Proof is difficult, as the flow of the stream has not hitherto been systematically observed, but facts can be adduced, (and will, if necessary, be adduced), which appear to support the view taken by the Department.

17. The rainfall of the part of Rajputana in which the Sambhar Lake is situate fluctuates greatly in quantity from year to year. The records of the observatory at the Departmental settlement near the town of Sambhar at the eastern end of the Lake show that during the past 30 years the annual rainfall has varied from 9·13 to 40·81 inches. The average fall of the five years which ended with 1895-96 was 24·64 inches; while that of a similar period ending with 1900-01 was only 14·82 inches. The distribution of the rainfall is also very capricious. There are no statistics of the fall which occurs year by year in the catchment areas of the feeder streams to the west and north-east, but an observer at the town of Sambhar may often notice heavy rain falling over the hills in the catchment area of the Rupnagar Nadi to the westward, while the fall at the Lake itself may be unimportant. There was a serious flood in the Lake in 1884-85; but the rainfall of that year at the town of Sambhar, though good, was not extraordinarily heavy; 25·08 inches were registered, a quantity which had been equalled or exceeded in four previous years without any flood occurring. In 1892-93, there was another flood, but the Lake did not fill to the same depth as in 1884-85, though the fall at the town of Sambhar was unprecedented, 40·81 inches. The recorded statistics of rainfall at localities outside the catchment areas of feeder streams are not, therefore, altogether a safe guide as to the quantity of rain which usually falls, or is likely to fall, within those areas.

18. The information in the possession of the Department may not be quite accurate or complete; but judging from the details which have been given in paragraphs 13 and 15 with regard to the projected Ontra dam and the dams at Kair and Ararka, it would appear that these works have not been, and are not likely to be, remunerative irrigation works; and that the number of persons who benefit by the construction of irrigation works of the kind is comparatively small. The Department has no desire to minimise the benefits of irrigation; it argues merely on the information in its possession, and it puts forward for consideration other interests which are involved and which appear to be weighty.

19. These interests are those of—

(1) The Government of India in the Finance Department.
(2) The population of the large area in which Sambhar salt is consumed.
(3) The Durbars of Jaipur and Jodhpur.
(4) The people who are resident in the neighbourhood of the Lake and those who resort to it in quest of labour.

20. During the 31 years that the Department has been in charge of the Lake, a capital sum of Rs. 7,18,118 has been expended upon the construction of large and permanent salt works. A quantity of maunds 96,288,309 of salt has been sold and Rs. 23,09,50,801 has been realised as revenue. The average yearly sales of salt during the past ten years have been maunds 3,921,686 and the average revenue realised during the same period has been Rs. 1,07,54,015.

21. The salt of the Sambhar Lake is consumed in five large administrative areas—the North-Western Provinces and Oudh, the Punjab, Rajputana, Central India and the Central Provinces. Taking the average sales of the past ten years, the quantity of salt issued from the Lake has sufficed for the wants (at 7 lbs. per head) of about forty-six millions of people.

22. The Lake lies within the territory of the States of Jaipur and Jodhpur, and has been leased from them for an annual fixed payment of Rs. 5,50,000, and a further fluctuating royalty payment of 40 per cent. of the price of all salt sold, in excess of a quantity of 17½ lakhs of maunds. During the past 31 years, Rs. 1,68,29,234 have been paid to the States on account of rent and Rs 47,19,220 as royalty, a total sum of Rs. 2,15,48,454. During the past ten years, the average annual payments have amounted to Rs. 7,58,700; Rs. 5,50,000 as rent and Rs. 2,08,700 on account of royalty.

23. The population of the country in the neighbourhood of the Lake is largely dependent upon salt manufacture. The towns of Sambhar and Nawa at the eastern and western ends of the Lake, with a population of about 12,000 and 5,000 souls respectively, are dependent upon the Lake for their prosperity, as they are principally inhabited by salt traders and persons dependent upon them, and by labourers who earn their living on the salt works. The people of the villages within a considerable radius resort to the Lake to earn a livelihood on the works, and labourers from localities far distant travel every year to the Lake for the same purpose. The labouring population have benefited to the extent of the large sum of Rs. 37,98,775, which has been expended by the Department at the Lake in the construction of salt works and the manufacture of salt during the past 31 years. The sum expended for these purposes during the past ten years amounts to Rs. 13,25,949, and the average sum expended yearly during the same period has been Rs. 1,32,595.

24 From the appended copy of letter No. 3779 S. R., dated the 13th of July 1901, from the Government of India, Departments of Finance and Commerce, to the address of the Honourable the Agent to the Governor General in Rajputana, it will be seen that the Government of India have declared that the question of the flow of water into the Sambhar Lake is one of grave concern to them, and that it is considered most inadvisable that anything should be done by the construction of new reservoirs or irrigation works, or by extending any of the existing works on the feeder streams, either in British territory or Native States, which will be likely to diminish the supply, and to thereby affect, temporarily or permanently the salt producing capacity of the Lake. The Government of India have further called for an opinion on the advisability of freeing the Rupnagar Nadi of some of the obstructions, which at present impede its flow, and this question is at present under the consideration of the Honourable the Agent to the Governor-General in Rajputana. With works which have been for several years in existence the Department recognises that it may now be impossible to interfere, but the dam across the Kair branch of the Rupnagar stream at Ararka, and the dam constructed in 1900 across the Sirsira Nallah at Rupnagar should, in its opinion, be removed, and the reconstruction of the dam at Kuchil should be prevented. The Department also is strongly opposed to the construction of any new works on the Rupnagar and its tributaries either in Ajmer or in the Kishengarh and Jodhpur States which may be likely to diminish the water-supply of the Lake.

25. The views above set forth have the concurrence of the Commissioner of the Northern India Salt Revenue Department.

No. 1875 S. R., dated 17th April 1900.

From—W. S. Meyer, Esq., *Deputy Secretary to the Government of India, Finance and Commerce Department,*

To—*The Commissioner, Northern India Salt Revenue.*

In reply to your letter No. 1016, dated 10th April, I am directed to inform you that the following telegram has been despatched by the Government of India, in the Public Works Department, to the Agent to the Governor General, Rajputana, and Chief Commissioner, Ajmer-Merwara:— *Mr. Ashton.* 22 Nov. 01.

"Government of India consider that the Ontra Tank should not be completed, and that the labour should be removed elsewhere as soon as practicable after filling up trench to ground level. Work done above this level may be removed, if labour cannot be immediately transferred elsewhere."

2. The remaining suggestions made in paragraph 11 of your letter will be dealt with subsequently.

List showing the tanks and reservoirs which exist on the Rupnagar Nadi and its branches.

Number and Locality.	Character of work.	Approximate date of construction.
	ON THE RUPNAGAR STREAM.	
(*Ajmer.*)	(*a*) *On the Ontra branch or main stream.*	
1 Madarpura	Tank. Earthwork pitched with stone	1899-1900.
2. Rasulpura	„ Masonry and earthwork embankment	1841-1847.
3. Kankria	„ „ „	1841-1847.
4. Ghegra	„	
5. Barla	„ „ „	1847.
6. Nareli	„ „ „	1841-1847.
7. „	„ Earthwork embankment	1841-1847.
8. Gowanri	„ „ „ across the stream with masonry escape.	1876-1877.
9. Ladpura	„ Masonry and earthwork embankment	1841-1847.
10. Budhol	„ „ „	1841-1847.
11. Mohami	„ „ „	1848.
12. Ghoriawas	„ „ „	1841-1847.
13. Akhri	„ „ „	1841-1847.
(*Ajmer.*)	(*b*) *On the Kair Nalah.*	
1. Lohagal	Tank earthwork and masonry embankment	1841-1847.
2. 3 4 Makarwali	3 Masonry and earthwork tanks connected with each other.	1841-1847.
5. Padampura	Tank earthwork embankment pitched with stone	1899-1900.
6. Chachiawas	„ masonry and earthwork embankment	1841-1847.
7. Kair	„ „ „ across the stream with masonry escape.	1890-1892.
8. „	„ earthwork embankment	1900.
9. Ararka	„ earthwork embankment partly pitched with stone	1848.
10. „	„ earthwork and masonry embankment with masonry weir across the stream.	1841-1847. Weir was raised in 1891-1892 and strengthened in 1899. Tank was also then repaired as a famine work.
(*Kishengarh.*)		
11. Narwar	„ earthwork embankment	1895.
12. Kuchil	„ masonry and earthwork embankment and a weir across the stream.	Said to have been constructed 40 years ago.
13. „	Overflow tank with earthwork embankment	1900.
(*Kishengarh.*)	(*c*) *On the Sirsira Nalah.*	
1. 2. Balaota	Tanks masonry and earthwork embankments across the stream.	Said to have been constructed 60 years ago. Said to have been constructed 30 years ago.
3. „	„ masonry and earthwork embankment	Said to have been constructed 40 years ago.
4. Sirsira	„ „ „ across the stream.	Said to have been constructed more than 30 years ago.
5. „	„ earthwork embankment	Said to have been very old.
6. Rupnagar	Tank earthwork and masonry embankment across the stream.	Said to have been constructed 30 years old.
7. „	„ earthwork and masonry embankment across the stream.	Made in 1900.
8. „	Earthwork embankment	Made or enlarged in 1900.
1. Thal	(*d*) *Near the main stream above Rupnagar.* Tank masonry and earthwork embankment	1894.
(*Jodhpur.*)	(*e*) *On the Parbatsar Nalah.*	
1. Parbatsar	Tank earthwork embankment and masonry escape	Old, but the Parbatsar Nalah was diverted from a point near its source into the tank in 1900.
(*Kishengarh.*)		
2. Dherund	„ earthwork and masonry embankment	Old, but was enlarged in 1900.

Mr. Ashton.

22 Nov. 01.

No. 3779 S. R., dated 13th July 1901.

From—The Government of India, Finance and Commerce Department,

To—The Honourable the Agent to the Governor General, Rajputana.

I am directed to forward copy of a letter from the Commissioner, Northern India Salt Revenue, No. 991, dated the 10th April 1901, on the subject of the water-supply of the Sambhar Lake.

2. The question of the flow of water into the Sambhar Lake is, I am to say, one of grave concern to the Government of India. In view of the way in which the manufacture of salt depends on a sufficient supply of water in the Lake and of the precariousness of the supply, the Government of India consider that it is most inadvisable that anything should be done in the shape of constructing new reservoirs or irrigation works or of extending any existing works on any of the feeder streams of the Lake either in British territory or in Native States, which will be likely to diminish the supply. It was in accordance with this principle that the construction of the Ontra Tank was put a stop to last year, and it is of great importance that the principle should be strictly enforced in future.

3. The Commissioner now proposes that the Rupnagar stream, which in years of short rainfall is the most important source of supply to the Lake, should be freed from some of its existing obstructions which are detailed in paragraph 13 of his letter. In making these proposals, the Commissioner has considered the opinions of intelligent and experienced officers of the Salt Department who have had intimate knowledge of the Lake for years, and he has satisfied himself by personal inspection that the measures proposed are necessary. I am to invite particular attention to the observations made in August last by the Assistant Commissioner of Sambhar which are referred to in paragraph 5 of the Commissioner's letter, and which seem to indicate that even moderate rainfall above the Ontra site may often now reach the Lake, although this was considered improbable by the Superintending Engineer (*vide* paragraph 7 of note on the Ontra Tank forwarded with your No. 108 J. S., dated 17th March 1900). It is possible that observations bearing on this point were also made by the officers of the Public Works Department, but whether this is the case or not I am to request that immediate orders may be issued to the local officers to take such observations of the flow of water in the Rupnagar stream during the present monsoon in comparison with the recorded rainfall as the character of the season will permit. I am also to suggest that early steps may be taken in communication with the officers of the Salt Department for the erection of suitable gauges and the maintenance of a continuous record of observation to be taken in the current and subsequent years which will indicate more fully and clearly the extent to which the supply of water to the Lake is being affected by the obstacles referred to by Mr. Dare.

4. I am also to ask for an early expression of your view on the proposals contained in paragraph 13 of the Commissioner's letter, and am to add that the Government of India desire that in future the Commissioner may be consulted before any of the existing works in British Territory or in Native States are enlarged, strengthened or improved.

Statement showing the rainfall, flow of the feeder streams and depth and density of the brine in the Sambhar Lake.

Month and date.	Rainfall.				Flow of the Streams.						Depth and density of the brine in the Lake.						
											Sambhar.			Nawa.			
	Sambhar.	Nawa.	Ajmer.	Jaipur.	Rupnagar.		Khariau.		Mendha.		Depth.		Density.	Depth.		Density.	
1901.	In.	In.	In.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Beaumé degrees.	Ft.	In.	Beaumé degrees.	
July 8th.	1·05	...	0·10	0·06	...	...	...	...	...	...	...	...	...	...	...	...	
„ 9th.	0·30	...	0·25	0·03	...	...	...	...	...	...	...	1	26°	...	...	...	
„ 10th.	...	...	..	...	...	...	...	...	...	...	...	1	26°	...	...	..	
„ 11th.	1·46	1·43	...	0·38	...	...	...	...	...	...	...	2	20°	...	...	...	
„ 12th.	0·91	·31	...	0·10	...	...	...	...	...	...	..	2	20°	...	...	...	
„ 13th.	...	...	...	...	...	...	...	...	...	...	...	3	15°	...	...	...	
„ 14th.	...	...	...	...	...	...	...	...	...	...	...	3	16°	...	...	...	
„ 15th.	...	...	...	...	...	...	...	...	...	...	...	5	12½°	...	..	...	
„ 16th.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
„ 17th.	...	...	...	...	...	...	...	...	...	...	...	...	26	...	...	...	
„ 18th.	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	
„ 19th.	0·34	0·15	2·05	...	...	10½*	...	...	...	...	..	7	10°	...	...	...	*On this date, two observations were taken and the average of the depth has been given.
„ 20th.	...	...	...	...	...	...	...	...	...	...	...	5	15°	...	...	...	
„ 21st.	...	...	...	0·30	...	...	...	...	...	...	...	3	16°	...	...	...	
„ 22nd	...	...	...	...	...	...	...	..	...	...	...	6	15°	...	...	...	
„ 23rd.	0·01	...	...	0·91	...	...	...	...	...	...	...	3½	12°	...	...	...	
„ 24th.	0·83	0·40	0·45	1·98	...	...	...	...	...	...	...	1	10°	...	2	19°	
„ 25th.	0·03	...	...	0·43	...	...	...	...	..	...	...	...	...	...	0·75	23°	
„ 26th.	...	0·24	0·10	0·06	...	...	...	...	...	...	...	5	23°	...	...	...	
„ 27th.	0·18	0·23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
„ 28th.	0·04	0·11	0·97	...	...	...	...	...	...	...	...	...	...	...	...	...	
„ 29th.	...	...	0·58	1·12	...	...	...	...	...	...	...	...	...	...	...	...	
„ 30th.	0·02	0·67	0·80	0·22	...	...	...	...	...	...	...	...	...	...	2	12°	
„ 31st.	...	...	0·02	...	...	6	...	...	...	...	...	5½	20°	...	4	12°	

Statement showing the rainfall, flow of the feeder streams and depth and density of the brine in the Sambhar Lake—concld.

Mr. Ashton

22 Nov. 01

Month and date.	Rainfall.				Flow of the Streams.						Depth and density of the brine in the Lake.						
											Sambhar.			Nawa.			
	Sambhar.	Nawa.	Ajmer.	Jaipur.	Rupangarh.		Kharian.		Mondha.		Depth.		Density.	Depth.		Density.	
1901.	In.	In.	In.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Beaumé degrees.	Ft.	In.	Beaumé degrees.	
August 1st	...	...	...	...	...	...	...	...	...	...	...	5	19°	...	3·50	10°	
,, 2nd	0·03	0·08	...	0·02	...	...	...	...	...	...	...	3	17°	...	1	13°	
,, 3rd	0·22	0·03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
,, 4th	0·02	...	...	0·11	...	...	...	...	...	...	...	...	...	...	...	...	
,, 5th	...	...	...	0·01	...	...	...	6·87	...	2·82	...	...	25°	...	0·75	23°	
,, 6th	0·03	0·60	1·51	0·07	...	...	1	0·54	...	8·05	...	5	12°	...	8	...	
,, 7th	1·95	1·66	1·02	3·35	...	7†	...	...	...	2·82	...	7	8°	...	10	...	†On this date, two observations were taken and the average of the depth has been given.
,, 8th	0·01	..	0·05	0·01	...	...	...	...	...	...	...	6	10°	...	10	...	
,, 9th	...	0·01	...	0·03	...	...	...	...	...	...	...	6	11°	...	9	..	
,, 10th	...	...	...	...	...	...	...	...	...	...	...	7	9°	...	9	3°	
,, 11th	...	...	0·05	0·01	...	...	...	...	...	...	...	8	10°	...	9	6°	
,, 12th	...	...	...	0·17	...	...	...	...	...	...	...	9	9°	...	9	6°	
,, 13th	..	...	...	...	...	...	...	..	..	...	...	6	10°	...	9	6°	
,, 14th	0·02	...	...	0·11	...	...	...	...	.	...	...	7	7°	...	9	4°	
,, 15th	0·94	0·43	0·15	1·30	...	...	...	...	...	...	...	2	6°	...	7·50	4°	
,, 16th	0·51	0·54	1·36	0·02	2	5	...	...	...	2·41‡	...	4	7°	...	9	4°	‡On this date, two observations were taken and the average of the depth has been given.
,, 17th	0·68	0·55	0·20	...	...	6	...	...	..	...	...	4	6°	...	9	4°	
,, 18th	...	0·12	0·05	0·03	...	...	...	...	...	...	..	3	6°	...	8·5	4·5°	
,, 19th	...	0·08	0·05	0·06	...	4	...	...	...	...	...	2	4°	...	8·5	4·5°	
,, 20th	0·08	...	...	...	...	...	...	...	...	...	...	6½	4°	...	9·5	4°	
,, 21st	...	...	...	0·57	...	...	...	...	...	...	...	9	7°	...	10	3°	
,, 22nd	...	...	...	..	...	...	...	...	...	...	...	8	9½°	...	10	3°	
,, 23rd	...	...	...	...	...	...	...	...	...	...	...	7½	11½°	...	9·50	3°	
,, 24th	...	...	...	...	...	...	...	...	...	...	...	8	10½°	...	9·50	4°	
,, 25th	...	...	...	...	...	...	...	...	...	...	...	7	8°	...	9·50	4°	
,, 26th	...	...	...	...	..	...	..	...	...	...	..	5½	11°	...	8	6°	
,, 27th	...	...	...	...	..	...	...	...	...	...	..	6	10½°	...	7·50	6·50°	
,, 28th	...	...	...	..	...	...	...	...	...	...	...	7	11°	...	7	7°	
,, 29th	...	...	...	...	...	...	...	...	...	...	...	4	12°	...	7	7°	
,, 30th	...	0·05	0·20	0 02	...	...	...	...	...	...	...	2	14°	...	6·75	8°	
,, 31st	...	...	...	0·06	...	...	...	...	...	...	...	4	13°	...	6·75	8°	
September 1st	0·02	0·01	...	...	...	...	...	...	...	...	...	7	13½°	...	6·75	8°	
,, 2nd	...	...	...	...	..	...	...	...	..	...	...	8	15°	...	8·50	9°	
,, 3rd	...	...	...	...	...	...	...	...	...	..	...	6	16°	...	7	10°	
,, 4th	...	...	...	...	...	...	...	...	...	..	...	5	17°	...	7	9°	
,, 5th	...	...	...	...	...	...	...	...	...	...	...	5½	17½°	...	7	10°	
,, 6th	...	...	...	...	...	...	...	...	..	..	...	6	18°	...	6·75	11°	
,, 7th	...	...	...	...	...	...	...	...	...	...	...	4½	18½°	...	5·5	11°	
,, 8th	...	...	...	...	...	...	...	...	...	...	...	4½	19°	...	5·5	11°	
,, 9th	...	...	...	...	...	...	...	..	...	...	...	4	19°	...	5·50	12°	
,, 10th	...	...	...	...	...	...	...	...	...	...	...	2½	20°	...	5	15°	
,, 11th	...	...	...	...	...	...	...	...	...	...	...	1½	21°	..	5	13°	
,, 12th	...	...	...	...	...	...	...	...	..	..	...	1	22°	...	4·5	13°	
,, 13th	...	..	...	...	...	...	...	...	-	...	...	...	22½°	...	3·50	12°	
,, 14th	...	...	0·25	...	...	..	...	..		...	...	...	21½°	...	3	14°	
,, 15th	...	...	...	...	...	...	...	...	...	...	...	...	25°	..	3	12°	
,, 16th	...	...	...	...	...	...	...	...	...	...	...	1	25½°	...	4	14°	
,, 17th	...	...	...	...	...	...	...	...	...	...	..	2½	25½°	...	3	14·5°	
,, 18th	...	...	...	...	...	...	...	...	...	...	...	2	25½°	...	3	16°	
,, 19th	...	...	...	...	...	...	...	...	...	...	...	1	25½°	...	3	17°	
,, 20th	...	...	...	...	...	...	...	...	...	...	...	1½	25½°	...	½	20·5°	
,, 21st	0·20	...	...	...	...	...	...	...	...	...	...	...	25½°	...	½	20·5°	
,, 22nd	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 23rd	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 24th	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 25th	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 26th	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 27th	...	...	...	...	...	...	...	...	...	...	...	...	26°	...	...	...	
,, 28th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
,, 29th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
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No. C. B.-1695, dated 6th November 1901.

From—The Secretary to the Musahib Ala, Marwar,

To—The Resident, Western Rajputana States, Jodhpur.

With reference to your office endorsement No. 3936, dated 31st ultimo, I have the honour to give below the annual rainfall at Nawa for the last ten years for which period alone reliable data is available:—

	Inches.	Cents.
1891-92 . . .	7	83
1892-93 . . .	26	65
1893-94 . . .	19	44
1894-95 . . .	13	3
1895-96 . . .	9	44
1896-97 . . .	11	45
1897-98 . . .	11	28
1898-99 . . .	2	60
1899-1900 . . .	10	40
1900-1901 . . .	28	38

No. 4067.

Copy forwarded to the Commissioner, Northern India Salt Revenue, Agra, for information, with reference to his No. 3019, dated 25th October 1901.

Mr. Ashton.

22 Nov. 01.

Q. (*The President.*)—I understand that the Salt Department have protested against the construction of certain tanks in the Ajmer territory and the adjacent territories. I am presented with a list of five tanks, which Mr. Manners-Smith has mentioned, and a feeder channel. I understand that the Salt Department object to these tanks being constructed. Do you object to the tanks that have been existing from all time?—These are new tanks. We object to the construction of any new tanks in the branches of the Rupnagar Nadi. We also want some of the old works to be lowered.

2. Q. Have you got any figures as regards the effect of this particular river, the Rupnagar, on the lake?—No; no observations have been made but the principal water that entered the lake this year came from that river. From that we shall get 12 lakhs of maunds of salt.

3. Q. Is your lake very low this year?—Yes, very low.

4. Q. What is the depth?—The average depth this year must have been about 6", in the centre 10" to 12", against an average in the centre of 4'

5. Q. I have calculations here which show that one filling of the four proposed tanks, three of which are in Kishngarh, would raise the surface of the Sambhar Lake only 1¾", the lake being estimated at 90 square miles. I suppose what I am to infer from that is that in an ordinary year of rainfall enough water would come down to fill the tanks eleven times over and that there would always be surplus water to pass on to the lake?—I think it would be the opposite. In an ordinary year the water might pass on; water might pass on in one flood and none at all in 6 or 7. Of course it must depend largely on the dimensions of the tank. You can make a tank big enough to stop all the water.

6. Q. Now take the Ararka weir. Does no water pass over that at all?—I don't think so. I am not certain about Ararka. None has passed over the Kair weir.

7. Q. Have you a list of the lake gauges for a number of years?—We have only taken them this year, since last rains.

8. Q.—You say you have only 2 or 3 inches of water in the lake?—This year it has been that; the lake dries up entirely every year unless a heavy flood comes down which is unusual. It was only last year that these bunds were brought to our notice. They are not under us and we cannot take observations. We do know that this year practically all the water we got was from the Rupnagar. We have a dam across the Lake to keep up a certain amount of water for the works at Nawa. It is repaired every year; it is broken by the water coming in every year.

9. Q. You say you got no water at all last year from the north side?—Practically none; there are no dams there, but during the past two years sand banks have been blown across the Mendha river; that is our great source of supply, but the tract is so sandy that nothing but very heavy rain comes down at all and we can't depend on it. The Rupnagar is our only steady source of supply.

10. Q. Is not a great deal of its water lost in a swamp?—Yes; that is a point we are going to take up as soon as this particular question is settled.

11. Q. (*Mr. Higham.*)—You propose to have old established bunds dismantled here because last year the only water came from that side?—Yes.

12. Q. You want to take these bunds down so as to get more water; in a year of good rainfall you get more water than you want?—Yes, when there happens to be heavy rain, but the regular rainfall is over the hills on the south side; even when the rainfall is slight we get water from the Rupnagar.

13. Q. I want to know whether you don't often get more water in the lake than you want?—Not more.

14. Q. Sometimes don't you get too much?—No; it has happened twice in 30 years. We then made very little salt, but it is after a flood that there is the greatest possible amount of salt. The flood is good for the lake, though bad for that particular year.

15. Q. If you get too little you can't make the salt?—Yes, even two inches are of importance to us, the wind banks the water up to 6 or 7 inches against our works.

16. Q. What is it you want to do with the existing tanks?—The weir at Ararka should be removed.

17. Q. Why should it be removed; how many years has it been made?—It was made in 1848.

18. Q. How can you justify pulling down a weir made 53 years ago?—We must think of the water-supply of the lake. The proposal to remove it has been made.

19. Q. Of course you will be prepared to pay compensation?—I could not say.

20. Q. How long have the Salt Department had the lake in their hands?—For the last 30 years.

21. Q. You admit that the bund was made long before you began making salt. If you take it down there will be a very good claim for compensation. When was the Kuchil dam made?—About 1848.

(Mr. Manners-Smith explained that the weir was built about 40 years ago; it was breached, and in the famine of 1898 they re-made it higher up; it again breached in 1900 and Mr. Dane's proposal is that they should not be allowed to repair it. I cannot say when the Kuchil dam first burst.)

22. Q. (*To Mr. Manners-Smith*)—Then the case of the Kuchil is that it is an old work?—Quite so, and the same with the Ararka weir which was made in 1848 and breached in 1883 and was repaired in the famine of 1898.

23. Q. (*To Mr. Manners-Smith*).—From 1883 to the famine year it has not been used?—No, it has not been used.

24. Q. (*To Mr. Ashton*).—That dam you want to remove was made in 1848?—Yes.

25 Q. Has that been kept up ever since?—I have no information.

26. Q. It seems to me that all the old works have been allowed to fall more or less into disrepair. In a time of short rainfall, however, when it is desired to repair them to what they originally were, you object?—When they are repaired we suffer.

27. Q. You suffer but you don't claim you have the power to prevent their being repaired?—We don't claim anything.

28. Q You are asking that they be removed?—The matter of their removal has been submitted.

29 Q You merely wish to represent that the dams injure you, or do you wish to represent their removal?—We wish to represent the removal of the Ararka bund; not of the Kair bund.

30. Q. But is not the low supply in the lake due to the same cause as that which has been operating in Rajputana, *viz*, a very short rainfall?—That is true, but we should have got enough possibly if all this had been free.

31. Q. If you have a short rainfall is that a reason why all the works should be stopped?—Short rainfall absolutely stops the salt works; the bunds stop the whole of the water. The dams high up on the branches don't do much harm and we don't object to them.

32. Q. (*The President.*)—Have you got statistics as to the source from which your supply of water comes?—No; it has not been necessary to take them; up to last year we took our short supplies as the natural order of things until we heard of the construction of bunds; then we made enquiries about them.

33. Q. (*Mr Ibbetson.*)—How long have you been on the Sambhar Lake?—I have known it since 1877 and have been in charge of it for 5 years.

34 Q. I understand your difficulty is that when water recedes beyond a certain point you can't get at it because the mud is soft; you give the depth of the water in the lake as six or twelve inches in a good year, at what time of year is that measured? Is that the maximum depth?—That would be in a bad year, it would be about 4 feet in a good year.

35. Q There is a point beyond which you cannot follow the water, and when making the salt from brine becomes impossible; when the brine is so far off that you cannot make salt, what would be the depth in the centre of the lake?—I cannot give that.

36. Q. How far would the water be below your gauges?—A mile or two away. The slope is about two feet in three miles

37. Q. What is the maximum height on your gauges to which the brine rises?—We have only taken these measurements since last year.

38. Q. You say that from a very small stream of water which the Rupnagar made you can make twelve lakhs from the brine. Why can't you run jetties out? Supposing you ran jetties out and had pumps operating?—Even then the water becomes too shallow to pump from. The weir might keep the water away altogether.

39. Q. You supply something like 66 million people with salt?—46 millions.

40. Q. Supposing the Sambhar Lakes closed to-morrow where would these people get salt from?—A number would get their supplies from Calcutta or from Bombay.

41. Q. Can you give any idea of the difference in the prices if people got their salt from Calcutta or Bombay? Can you tell us very roughly?—I cannot give figures as railway freights would have to be worked out.

42. Q. Do you think it would increase the prices very much?—The price would be increased.

43. Q. Have you figures for the quantity manufactured each year?—No; I have not the figures by years.

44. Q. (*Mr. Rajaratna Mdlr.*)—Has there been an appreciable diminution in the quantity?—There has been.

45. Q. (*The President*)—Have you got manufacture going on over the whole 90 square miles?—(Witness explains from map.)

Mr. Ashton.

22 Nov. 01.

46. Q. What I want to know is, when a limited supply is spread over 90 square miles and salt could be obtained from other places, why it is necessary to keep on the South East works?—There is an advantage in having a number of centres of distribution.

47. Q. Why is it necessary to allow the water to spread over 90 square miles? Do you require such a large area for your manufacture? Could you not put a bund round to keep in the water in a small area?—It would be a great expense to bund portions of the lake off to convey the available water into them.

48. Q. (*Mr. Rajaratna Mdlr.*)—What is the cost price at which you sell?—Four annas.

49. Q. What is the maximum quantity you have made in one year?—Seventy lakhs.

50. Q. To what distance is the salt distributed from your works?—Our salt meets the Bombay salt in the Central Provinces and the Khargora salt in Central India.

Witness No. 14.—Mr. G. T. Williams, C.E., State Engineer, Meywar.

Witness put in the following documents:—

1. Preliminary Investigation Report, Famine Protective Works (printed below).

2. Statement of existing Famine Protective Works, Meywar State.

3. Statement of proposed works.

4. Statement of annual expenditure on all Irrigation works since 1885.

5. A map of the State.

Mr. Williams.

22 Nov. 01.

Meywar State.

General Report of Famine Protective Works.

Area.—The Meywar State has an area of about 13,000 square miles, of which 4,000 miles is *Khalsa* and 9,000 square miles *Jagir* and *Muafi*

Population.—The population of Meywar, as recorded in the census of 1881, was 1,813,213, and as recorded in the last census was 1,018,805.

Cultivation.—The area of 13,000 square miles may be divided thus,—two-thirds may be considered as hilly and unproductive, and one-third as arable soil. This one-third may be considered as a unit and should be re-divided, one-third being irrigated and two-thirds as un-irrigated. Three hundred square miles Khalsa is under irrigation (10 square miles under tanks and 260 miles under wells), which means that out of every 7 square miles, 1 mile is under tank and 6 miles under well cultivation. From the 700 square miles Khalsa which are Kankar, about 100 square miles may be brought gradually under well and tank cultivation.

Towns and villages.—This State has altogether one city (Udaipur the capital), 12 *kusbas* and 6,038 villages according to the last census return.

Revenue Settlement.—The Revenue Settlement does not embrace the wild and hilly districts and only approximate figures can be given.

Khalsa lands, Jagir and Muafi lands.—Also the three forms herewith submitted deal solely with Khalsa and not with Jagir and Muafi Irrigation Works or lands, of the latter there are no statistics.

Hills.—The Arravelly Hills running north and south with off-shoots east and west eventually merge into the Vindhya Range near the valley of the Jukhum to the south-east and they constitute the main physical feature of this State.

Rivers.—The drainage of all the western portion of Meywar is southward and embraces the principal sources of the Soburnutty and the Luny. The drainage of the eastern and northern portions of the State flows east and forms the Banas, which river in its course to the Chambal receives as affluents the Khary, Kothary, Baruch, Gumbery, Bajun, etc. The drainage of the southern portion flows into the Mahi and thence into the sea, receiving in its course the Swam, Jukhum and others.

Perennial streams.—No rivers are perennial in Meywar, and even the Banas in the greater part of its course through the State has water as a rule only in pools, during the hot weather. In good seasons these nallahs have a flow of water for four months (September, October, November and December) in the year.

Index map.—In the Index map which accompanies this report, existing works are numbered and marked in red circles; proposed works are numbered and marked in blue circles; and works requiring further investigation are numbered and marked in green circles.

Existing Tanks, Form No. I.—Of the 99 existing irrigation tank bunds named, and given in Form No. I

81	Nos.	have catchment areas from	1 to 5 inches.
11	do.	do.	5 to 10 „
3	do.	do.	20 to 50 „
1	do.	do.	50 to 100 „
2	do.	do.	100 to 200 „
1	do.	do.	of 690 „

The principal ones are:—

Jai Samund—Popularly known as Dhibor, is the largest artificial lake in the world, built more than 200 years ago, has a catchment area of 690 square miles, and covers an area of 21 square miles. Its capacity is 20,000 million cubic feet, about 6 square miles of irrigation is done below the lake. This is being extended by means of the canals. The cultivation of Rubi on the margin of the lake is 14 square miles and profitable to the jagirdars of Salumbar, Korabar and Bhodoser and others.

Raj Samund.—Raj Samund, the second in size of the large tanks, has an area of 3 square miles, was built in the famine year of 1661. Has a catchment area of 195 square miles with a capacity of 2,200 millions cubic feet, canals water 4,000 bighas, while the silt deposited by floods has raised the bed of the tank and yields good rabi crops as the water subsides.

Oodey Sagar—The Oodey Sagar Lake, built in 1560, has an area of 2 square miles with a catchment area of 185 square miles and a capacity of 836 million cubic feet. It irrigates 2½ square miles below the bund, along the margin and low-lying ground 2,000 bighas furnish rabi crops without watering.

Bibola.—Built in 1568; has an area of 1½ square miles with a catchment area of 156 square miles and a capacity of 418 million cubic feet, irrigates the large public gardens below the bund. Keeps up the springs of wells, and is both ornamental and useful to the capital. The palace rises from its banks and a good portion of the city is built on its margin.

Fatah Sagar.—Built during the reign of the present Maha Rana; has an area of 1 square mile, a catchment area of 9 square miles, and a capacity of 563 million cubic feet. It is fed by a canal 4 miles in length from the Baruch River.

Suri.—Tank built at the close of the 17th century, is picturesquely situated in the hills north-west of the capital. Its greatest depth is 75 feet with clear water, has a catchment area of 5 square miles, which was increased by 1 square mile during the last famine. Its capacity is 410 million cubic feet.

Mr. Williams.

22 Nov. 01.

Other old tanks.—Mandal, Ghassa, Lakhola, Kapasum, Dindoly, Nandeha, Daboke, etc., are large ancient tanks and confer an immense benefit on the State.

A land of tanks.—Meywar is essentially a land of tanks, almost every village has one or more, may be large or small. A shower of rain fills it up, here the cattle are watered, and if the water is clean the farmer has his morning ablutions, while the springs in the neighbouring wells are raised. Rabi is raised in the hill. In Form No. I some of the best known and most prominent are noticed.

New tanks.—Khemly, Ramsur of Nand Roy, Kotri, Amerwasi, Polya, Barundong, Gobind and others built lately during the last famine will be of lasting benefit to the State.

A popular belief.—It may be asked, that although this State has such magnificent tanks and rivers scattered over its area in every direction, why so little irrigation has, till lately, been done from them. The reason is, it was an old and firm belief, that to build a tank solely to store water, in which cattle could quench their thirst and animal life could exist, while the trees on the banks could afford shelter to the weary traveller from the noon-day sun, was considered a pious act likely to prove beneficial to the donor in after life, while to use the waters thus stored up for pecuniary advantage in this world, was considered as an act detracting and taking away so much in proportion from the ultimate and main beneficial object in view. It is for this reason why all the old tanks have no irrigation sluices.

Proposed works, Form No. II.—As noticed previously in the accompanying index map, proposed works are numbered and marked in blue. The names and brief particulars of these 77 are given in Form No. II:

70	have catchment areas from		1 to 5	square miles.
2	do.	do.	5 to 10	do.
1	do.	do.	10 to 20	do.
1	do.	do.	20 to 30	do.
1	do.	do.	50	do.
1	do.	do.	80	do.
1	do.	do.	100	do.

These proposed works will irrigate 32 square miles of Khalsa land.

Famine Programme.—The numbers for which relief is required when Famine occurs may be assumed as 8 per cent. out of a population of 1,025,000 souls in the State according to the last census, considering that half, *viz.*, 512,000 is Khalsa population. Work has to be provided daily for 41,000 units—while our programme in Form II provides work for 120,000 daily for three months, hence the 41,000 can be employed daily for nine months.

Form No. III.—In addition to these projects four have not been worked out. They are marked and coloured green in the index map. They form Part III, require further investigation, and if found feasible should, it is thought, be of advantage to the State.

Water required.—The quantity of water required for irrigation, allowing for absorption and evaporation, is considered as 50,000 cubic feet per bigha.

Water running off.—In all the estimates the quantity of water available for storage has been considered as one-third flowing off on stony and hilly ground, and one-fourth as flowing off on flat black cotton soil of the total rainfall.

Rainfall.—The rainfall of the State of the last ten years as registered in the Central Jail at the Capital is—

Years.	Inches Cents.
1891	20·18
1892	26·08
1893	47·77
1894	32·58
1895	15·27
1896	29·18
1897	23·89
1898	18·39
1899	9·78
1900	41·15
An average of	26·427

PART III.

Meywar State.

Suspense works.

Points to be investigated later on in regard to new Irrigation Works:—

1. The Khari Project for binding up the Khari River, which forms boundary between Ajmer District and Meywar near Barul Station on the Rajputana-Malwa Railway, would have to be undertaken after agreement with the Ajmer authorities. Plan of canals already proposed by Mr. Monckton in 1884.

2. For bunding up Ganeri River near Chittore, to irrigate lands on both sides of Chittore Fort, not yet investigated or planned.

3. For bunding up Baruch River above Akola, not yet planned or estimated.

4. For bunding up the Banas River at the Kotar gorge, 20 miles west of Nathdwara.

No. 1733, dated 20th September 1901.

From—The Resident, Meywar,

To—The Secretary to the Honourable the Agents to the Governor General, Rajputana and Central India, Public Works Department.

In continuation of this office letter No. 1476, dated 9th August 1901, I have the honour to forward the accompanying report prepared by Mr. Williams, State Engineer, Meywar, with enclosures, furnishing the preliminary information required for the Famine Irrigation Programme of the Meywar State.

2. The information furnished by Mr. Williams is as complete as possible, and I trust it will be found sufficient.

3. The data for 30 of the projects in Form II have been carefully prepared by European Engineers, such as Mr. Campbell Thomson, formerly in the service of the Darbar; 47 that have since been prepared by Mr. Williams, the present State Engineer, would probably require scrutiny by an Irrigation Engineer.

4. With regard to the new works mentioned in Form III accompanying the Report, I would suggest that the Darbar be asked if they would agree to a competent Engineer Officer being deputed to Meywar to examine and prepare estimates and plans of the proposed works. These latter works, and especially that for damming the Banas River at the Kotar gorge, if possible, would be most useful for storing up water for irrigation purposes in anticipation of famine.

1. Q. (*The President.*)—You are State Engineer of Meywar?—Yes.

2. Q. How long have you been in that position?—Since 1868.

3. Q. And you know the State thoroughly?—Yes, I was born there.

4. Q. Meywar suffered very badly in the famine?—Yes.

5. Q. You lost nearly half the population?—Yes.

6. Q. Are the emigrants coming back that went away? I suppose a great number left the State?—Our people as a rule don't emigrate.

7. Q. You have had a diminution of 85,000 in the population?—Yes.

8. Q. You mention in your memorandum a very interesting thing which I have never heard before, that many tanks made in the old days were not made for irrigation purposes. Is that so?—Yes, it is a fact. We go so far as to cultivate the bed of tanks, but in Rewa they don't even do that.

9. Q. You say the old tanks had no irrigation sluices; have they got sluices now?—Yes, they have all got them.

10. Q. (*Mr. Ibbetson.*)—On the old tanks you have made irrigation sluices?—Yes.

11. Q. (*The President.*)—You say "the Jai Samund is the largest lake in the world." Yet it irrigates only 6 square miles or 3,048 acres?—Yes.

12. Q. Why is not more use made of it?—We make use of it now. The chief reason is the land belongs to the Jagirdars who will not give us water cess.

13. Q. And therefore you don't give them water?—Yes.

14. *Q.* Is that being corrected?—Yes. Now as they give us cess we give them water.

15. *Q.* Had you plenty of water in the famine year?—Yes, but it was below the sluices.

16. *Q.* How much was irrigated by that great lake in the famine year?—A good deal of the bed of the tank. That is our principal means of cultivation in Meywar.

17. *Q.* Then you mention the Khari project, do you know anything about that project?—Yes, the site is near Karel on the railway and from there Mr. Monckton took levels to Guggera, Hurra and other places.

18. *Q.* It was never gone on with?—No.

19. *Q.* Is there much information about it?—Have the levels been taken?—Yes.

20. *Q.*—Is that what is called "Monckton's" project?—Yes.

21. *Q.* What is the discharge of the Gameri river?—I don't know. The largest river we have is the Banas.

22. *Q.* You propose to bund up the Banas at the Katar Gorge?—Yes, that is a likely place for it.

23. *Q.* What is the extent of well irrigation; you say 40 square miles are irrigated by tanks and 260 square miles by wells?—Yes. There are a great number of wells all over Meywar.

24. *Q.* How deep is the water surface?—25 to 30 feet.

25. *Q.* A great deal of well irrigation goes on?—Yes. The tanks serve to keep the water high as do many of the rivers. The water along the Khari river is very high.

26. *Q.* The tanks I suppose cease to irrigate about December?—No, about February.

27. *Q.* They give all the water required for the rabi crop?—Yes.

28. *Q.* And they fill again in July or August?—Yes.

29. *Q.* They don't require the assistance of the wells to mature the rabi crop. The tanks themselves do it?—Yes.

30. *Q.* How did the small tanks behave in the famine year?—They all dried up and have been practically of no use since the famine.

31. *Q.* Since the famine have the people been making more wells or more tanks? Have they been impressed with the necessity for these works?—Yes, they have been impressed with the necessity for tanks.

32. *Q.* Are they making these themselves? They can't do it themselves. They are assisted by the Durbar. The famine has been very severe and struck the people very badly and the State also.

33. *Q.* Are they not making more wells?—In the famine year they sank wells from takavi.

34. *Q.* Did the wells hold out during the famine?—Very few, there was no cultivation in the famine.

35. *Q.* Does the Durbar give takavi for wells?—Yes, very freely.

36. *Q.* Can the poor man who wants to make a well get takavi easily?—He has to find security.

37. *Q.* Are more wells being made now?—Yes.

38. *Q.* How much does a well cost?—From Rs. 300 to Rs. 600.

39. *Q.* Does the Durbar charge interest for takavi advances?—Not that I know of.

40. *Q.* In how many years does the money have to be paid back?—I could not tell you; there is no fixed period.

41. *Q.* Do you think the Durbar is anxious to extend irrigation?—Very much. It has done more in the famine year than any other State I know of and has spent all its money on irrigation and other works.

42. *Q.* Will these larger projects that you have talked about be favourably received?—Yes, money allowing.

43. *Q.* (*Mr. Ibbetson.*)—Is the State fairly well off?—No. This year we wanted to borrow money and could not. The State has only come to itself since the British occupied the country.

44. *Q.* I see in a number of these projects there is black cotton soil. Will the people take water for this soil?—Yes; of course black soil requires less water than any other soil.

45. *Q.* They will take water. Will they pay for it?—Yes; because they have no cattle left.

46. *Q.* I don't see what the cattle has to do with it. I understand that black cotton soil does not require to be irrigated?—Yes, but the soil we have can be irrigated; some of it does not take irrigation but yields poorer crops.

47. *Q.* The people are willing to take the water and pay for it?—Yes.

48. *Q.* (*Mr. Higham*)—How long have you been in Meywar State?—About 40 years.

49. *Q.* What is the public works expenditure?—About 4 lakhs on an average. In the famine year I spent about 8 lakhs.

50. *Q.* What was the 4 lakhs spent on?—(Witness produces statement to explain.)

51. *Q.* Twenty-five and a half lakhs were spent on famine works?—Yes.

52. *Q.* Did you employ famine relief labour on all the works?—Yes.

53. *Q.* What were the works besides irrigation?—We enlarged our jails, palaces and roads.

54. *Q.* The bulk of the money was spent on irrigation works?—Yes, and about 2 lakhs were spent on the railway and 3 lakhs on the nobles and officers of the Government.

55. *Q.* I see from this statement that between 1889 and 1892 you spent over a lakh a year on irrigation works. That is a great deal more than you spent in any other years?—Yes.

56. *Q.* Why did they spend money then; was there a famine?—No there was no famine.

57. *Q.* In other years you seem to have spent about Rs. 30,000 a year, was there any special reason for spending more between 1889-1892?—The special reason is that we took up the big Batch Sagar tank which is the principal work in the reign of His Highness.

58. *Q.* In other years you apparently spent Rs. 70,000 out of 4 lakhs. The rest all went upon roads and buildings?—Yes. We built a railway 75 miles long which cost a quarter of a million.

59. *Q.* What is the Meywar bigha?—Taking it roughly 2 bighas make an acre. To be more exact, however, 1·65 bighas go to an acre.

60. *Q.* What do you mean by the area protected? Is that the area actually irrigated in one year?—Yes.

61. *Q.* You have no statement of the total annual irrigation. Can you give that?—(Witness produces statement to explain.)

62. *Q.* Referring to your statement in which you show that the existing tanks irrigate 24,000 acres and that the area has doubled since 1884; is this increase of area new land brought under assessment?—We get no land revenue from land to which we have given water after the settlement. The increase in the statement is new land brought under cultivation.

63. *Q.* In the course of these years you have brought 12,000 acres more under cultivation?—Yes The famine works carried out remain quite separate. This year we anticipate an increase.

64. *Q.* You don't put water rate upon any land?—Yes we do. on new land; the rates are Rs. 1-12-0 to Rs. 3-12-0 per acre

65. *Q.* When new land is brought under irrigation you put on a water rate?—Yes.

66. *Q.* Which do you think is the most promising project?—No. 62.

67. *Q.* You require seven lakhs of rupees for that?—Yes.

68. *Q.* Any others?—Yes, the Karera

69. *Q.* (*The President.*)—That is Rs 2,30,000?—Yes.

70. *Q.* (*Mr. Higham.*)—Which would you advise if you were asked?—Nos. 6 and 10.

71. *Q.* Why?—Because they would be profitable.

72. *Q.* The other works you think would be all right to employ relief labour on?—Yes, but now every year we make more tanks.

73. *Q.* How have you got at the estimated area to be irrigated?—We allow 50,000 cubic feet for one bigha or 100,000 per acre.

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74. Q. Do you estimate that the proposed tanks will fill up to their full capacity in average years?—Yes in a normal year.

75. Q. Are not your tanks made to hold a great deal more than can be got into them in a normal year?—Yes.

76. Q. How do you get column 15—increase in revenue?—By comparing the difference in the value of irrigated and unirrigated land; 24 *minus* 9=Rs. 15.

77. Q. Is the revenue taken in kind?—Wherever we have got our settlement we take it in cash.

78. Q. (*Mr. Ibbetson.*)—You take both water rate and land revenue?—My department works only on water rate. In the statement I have entered both water rate and land revenue.

79. Q. Does the black cotton soil take all the water you can give it?—It takes less water than other soils.

80 Q You say you allow 50,000 cubic feet per bigha; do you allow less than that when you have black cotton soil?—Yes.

81. Q. What do you allow then?—Say 40,000 cubic feet.

82. Q. You have shown here the amount of labour you would employ for three months on these works. How much can be done by famine labour?—The whole of it.

83. Q. You can't do masonry with famine labour?—Yes, we can I think it is a popular misconception that famine labour can't be employed on masonry. On the Khemli tank I employed only 40 masons, all the rest was done by relief labourers who were employed in collecting and carrying materials.

84. Q I suppose the masons were not famine labourers?—Yes, they were.

85 Q. I suppose a man won't do as much work on famine as on ordinary labour?—No. The men say "the Sirkar has started work for us and we will do as little as we can."

86. Q. What proportion will they do?—I can't say. We try to get as much work out of them as we can.

87. Q. (*Mr. Rajaratna Mdlr.*)—You say in your report that all these works are proposed for khalsa lands only?—Yes.

88. Q. Are the *jagir* lands separate?—They are all mixed up.

89. Q. You do nothing for the *jagir* lands?—Not in this programme, although we started work separately for them in the famine.

90. Q. Can't you start tanks for the *jagirs*?—No, we can't do that.

91. Q Don't you make any tanks for the *jagirs*?—The *jagirdars* themselves make them, a friend of mine has made a fine large tank lately.

92. Q. Is that for the benefit of his own *jagir*?—Yes.

93. Q. Does it supply any other *jagir*?—It is not completed yet.

94. Q. Do the *jagirdars* ever combine?—No, never.

95. Q.—The State never makes works like these in *jagir* land?—No.

96. Q. I suppose the land is so mixed up you can't help it?—No. When we can't help it, of course we allow them water.

97. Q. (*Mr. Ibbetson.*)—Are the rates for them lower or higher than in the khalsa?—They pay Rs. 2 per acre instead of Rs 1-5-0.

98. Q. Are not all these old tanks very troublesome owing to the silt deposited in them?—The Pichola lake built in 1568 is half silted up. The Oodey Sagar lake built in 1560 is also silting, and the size of the lake is gradually reducing.

99. Q. Have you any idea how fast it goes on? How many feet of silt have you in the Pichola lake?—Nothing under 20 feet, I should say. The Jai Samand has only 3 feet, as the water first flows through the hills where the sand is deposited.

100. Q. (*Mr. Rajaratna Mdlr.*)—In your report you say there are nallahs which flow for about 4 months in the year. Are these nallahs utilised for irrigation purposes?—Yes.

101. Q. Is there any direct irrigation from them?—Only in one case.

102. Q. Are they utilised in some way or other?—Yes. Only in one case though have I dammed up the stream.

103. Q. You say that your programme of relief works provides for 8 per cent. of the population as liable to come on relief. What was the number on relief works in the last famine; was it not much more than 8 per cent. ?—Yes.

104. Q. How much more?—It could not be more than 16 per cent.

105. Q. What was the highest number on your relief works?—I should put it down at about 16 per cent.

106. Q. Then you have not provided for a sufficiently high percentage of the population. You say you calculated the numbers at about 5 men per rupee, that gives 3 annas, how much grain will that fetch in time of famine?—Half a seer a day.

107. Q. How much is half a seer?—50 tolas. Our rupee is only ten annas and our seer is 100 tolas.

108. Q. In Part 2, the area that will be irrigated by work No. 8, in years of drought is given at 200 acres greater than that to be irrigated in normal years. How is that?—The bed of the tank is included. That is cultivated in famine years.

109. Q. It is not cultivated in ordinary years?—No, because there is water in it.

110. Q. That occurs in some cases only?—No, in every case.

111. Q. Have you any information as to the advances given for the construction of wells?—No, it is not in my department.

112. Q. Is the settlement for a definite period?—Yes.

113. Q. Suppose a well is constructed two years before the settlement expires, will there be any enhancement?—That depends on the settlement officer.

114. Q. When an irrigation work is made is not the land revenue increased during the settlement?—No.

115. Q. Not on the old lands if the irrigation is new?—No. I am now fighting for that and have been for twelve months.

116. Q. In the Pichola lake is cultivation of the bed allowed?—Yes.

117. Q. Is the silting due to constant cultivation year after year?—Yes, to a certain extent.

118. Q. Within the catchment area, cultivation is allowed?—Yes.

119. Q. I suppose that has been going on for years and cannot be stopped?—Yes, it has been going on from time immemorial.

120. Q. (*Mr. Ibbetson.*)—You say, Mr. Williams, that "a large portion of the culturable area is irrigated." Can you tell us what proportion of the cultivated area is irrigated?—I don't know.

121. Q. You say when a man takes takavi he has to give security. What security does he give? Has he to get some one else to give it or does he mortgage his land?—He does not have to mortgage his land, but he has to show that he is a man of means.

WITNESS No. 15.—RAO BAHADUR SHAM NATH, Executive Engineer, Ajmer Provincial Division.

Pandit. Sham Nath.

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Witness put in the following documents:—

1. General Report on Irrigation Works in the Ajmer-Merwara State (printed below).

2 Statement showing area irrigated from Tanks in the Ajmer-Merwara State.

3. Statements of existing Famine Protective Works in the Ajmer, Todgarh and Beawar Tahsils.

4. Statement of proposed Famine Protective Works.

5. Initial statistics of Tanks—Works.

6. A Map of Ajmer-Merwara State.

7. Printed report on the settlement of the Ajmer-Merwara Districts, by Mr. R. S. Whiteway.

8. Printed list of tanks and Irrigation Works in Ajmer-Merwara, by Mr. R. S. Whiteway.

9. Printed copy of problems left after the Famine in the Ajmer Merwara State, by Mr. A. L. P. Tucker.

General Report on Irrigation Works in Ajmer Merwara State.

The total number of works in Ajmer Merwara is given below:—

	Finished.	Unfinished.	Total.
Ajmer . . .	123	...	123
Beawar . . .	165	2	167
Todgarh . . .	97	2	99
Total . .	385	4	389

These are all storage works. All the above tanks, with the exception of the following, are either new or completely restored works, dating from the administration of Colonels Hall and Dixon.

Ramsar in Ajmer.

Kalinjar, Dilwara } in Merwara.

2. Total areas in acres as irrigated by the above Government tanks for each year from 1870-80 are detailed in the accompanying Statement A, previous records from 1860-70—the date of transfer of Irrigation Works to the Public Works Department not being available.

3. The initial and annual statistics with regard to the following five typical tanks, viz., Bhir, Rajoli, Nimrai, Palsi and Jawaja as required in paragraphs 3 I and 3 II are given in the accompanying six statements.

4. Total expenditure of Rs. 49,50,472 incurred on old works can be distributed between (1) Capital outlay of Rs. 29,39,073, and (2) Maintenance and Repairs, etc., amounting to Rs. 20,10,399. The cost of all establishment including share of Executive Engineer's and Superintending Engineer's pay and also the cost of Revenue Collection is included in the above figures, which also include Rs. 1,48,250 on account of indirect charges.

5. The scale of water rates is different for the various classes of tanks. The first class or crop rate tanks have fixed rates per acre for various crops as given below:—

	Rs.	A.	P.
Ordinary autumn crop per crop .	3	12	0
Cotton per crop . . .	5	0	0
Spring crops per crop . .	5	0	0
Lucerne per annum . . .	5	0	0
Sugar-cane and opium per annum	7	13	0
Rice per annum . . .	10	15	0
Gardens	11	14	0
Sowing waterings . .	1	4	0

For the variable tanks or tanks of the second class there are maximum and minimum rates for each and every village. A rate midway between the two is struck for the purposes of assessment each year. There are no rates for flow or lift separately or for double crops. In kharif the number of waterings is not taken into consideration, but in rabi if water falls below the sluice level on the 15th February the assessment is made on number of waterings, *vide* rule 16 (5) of the Irrigation Rules. For levying the rate, *vide* rules 16 and 17 of the Irrigation Rules, as regards variable tanks. For fixed or third class tanks assessment has been made at the time of settlement and the same amount is received year after year. In first class tanks the assessment is made each harvest according to the rates given above. The system of taking share in kind is not in vogue here.

The Jagirdars pay water rate only and they have paid nothing towards construction charges. The whole amount assessed as water revenue goes towards the works.

Wells, 1 to 2 waterings.
Wheat, 2 waterings.
Cotton, 3 to 5 waterings.
Gram ... Ditto.
Barley ... 6 to 7 waterings.

6. The crops mainly irrigated are cited on the margin together with the number of waterings usually given to them. The period of watering is as given below:—

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Kharif Crops.

Early crops, June to December.
Late crops, October to December.

Rabi Crops.

October to March.

The distribution of water from first class tanks is controlled by the Assistant Commissioner and from second and third class tanks by village *panchayats*. In July a list is prepared for each tank of the first and second class showing names of all persons entitled to receive water from these tanks and they take water in the order in which the names stand on the list; water is given once to all on the list and again the same process is repeated till there is water in the tank and till the irrigation is completed.

7. There is no black cotton soil in Ajmer and Merwara.

8. There are no new irrigation works of large size possible in Ajmer Merwara. The one, *viz*, Khari Nadi Project shown in Part I is suggested for Istimrar States of Bhinai Bandanwara and part of Kishengarh Territory. But probably there would be objections to the above project on the part of the Udaipur Durbar as the head works will be in the Meywar Territory.

9. The works on which relief labour was mainly employed during the last famine were improvements to the existing roads and tanks and construction of new roads and tanks.

The following new works were commenced and completed during the last Famine:—

Ajmer District.

1. Padampura Tank.
2. Madarpura Tank.
3. New Brigchiawas Tank.
4. Dhani Tank.

Merwara District.

Beawar Tehsil.

1. Nimrekhera.
2. Barl.
3. Jalia II (Pithawas).
4. Lotiana.

Todgarh Tehsil.

1. Khara Ra'a.
2. Rati Magri.
3. Dand Bijal.

The following new tanks remained unfinished:—

Ajmer District.

1. Outra Tank.

Merwara District.

Beawar Tehsil.

1. Makrera Tank.
2. Bar Rapat.

Todgarh Tehsil.

1. Kukorkhera.
2. Asan.

It is now proposed to complete Makrera, Kukorkhera and Asan Tanks.

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The above tanks after completion would increase the irrigated area of the District by 1,160 acres as detailed below:—

Makrera	1,000 acres.
Kukerkhera	100 „
Asan	60 „
TOTAL	1,160 „

It is decided not to complete the Ontra Tank as its construction was objected to by the Salt Department, as it would have interfered with the Sambhar Lake Supply. Bar Rapat may have to be completed as a Famine work at any time when no other suitable work may be available for famine labourers. Yes, useful employment can be found for relief labour in improving and strengthening existing works and on completion of unfinished new tank works of last famine and a programme of possible relief works is maintained.

AJMER PROVINCIAL DIVISION A.

Statement showing areas irrigated from tanks.

Year.	AJMER.			BEAWAR.			TODGARH.			TOTAL.			REMARKS.
	Variable and fixed	Crop rate.	Total.	Variable and fixed	Crop rate.	Total.	Variable and fixed.	Crop rate.	Total.	Variable and fixed.	Crop rate.	Total.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1879-80 .	14,402	1,010	15,412	8,913	296	9,209	2,272	...	2,272	25,587	1,336	26,923	
1880-81 .	8,660	435	9,095	7,924	122	8,046	3,338	...	3,238	19,922	557	20,479	
1881-82 .	11,575	581	12,156	10,798	759	11,557	3,501	...	3,501	25,874	1,340	27,214	
1882-83 .	13,359	263	14,622	12,831	1,977	13,908	3,977	...	3,977	30,167	2,340	32,507	
1883-84 .	9,191	689	9,880	12,709	1,056	13,765	4,893	...	4,893	26,793	1,745	28,538	
1884-85 .	13,557	659	14,216	12,301	982	13,283	4,298	304	4 602	30,156	1,975	32,131	
1885-86 .	...	...	16,126	12,012	1,875	13 917	4,417	277	4,694	...	...	34,737	
1886-87 .	12,561	433	12,994	11,121	1,450	12,571	4,362	378	5,740	28,044	2,261	30,305	
1887-88 .	17,172	650	17,822	13,070	1,593	14,663	4,583	557	5,140	34,825	2,800	37,625	
1888-89 .	...	...	14,873	...	...	15,920	...	...	5,207	...	...	36,000	
1889-90 .	16,938	...	...	18 007	...	...	4,103	...	...	34,048	...	...	Crop rate totals not available.
1890-91 .	12,235	367	12,652	11,809	1,373	13,182	2,569	114	2,683	26,663	1,854	28,517	
1891-92 .	4,064	69	4,133	4,228	472	4,700	2,901	253	3,154	11,193	794	11,987	
1892-93 .	16,488	643	17,131	4,983	973	5,956	12,902	341	13,243	34,373	1,957	36,330	
1893-94 .	14,228	694	14,922	12,992	1,362	14,354	4,691	277	4,968	31,911	2,333	34,244	
1894-95 .	13,987	535	13,522	12,943	1,589	14,532	4,424	442	4,866	31,354	2,566	33,920	
1895-96 .	14,789	863	15,652	9,842	983	10,825	3,984	668	4,652	28,615	2,514	31,129	
1896-97 .	13,907	337	15,294	13,852	2,379	16,261	4,713	467	5,180	32,502	4,233	36,735	
1897-98 .	16,170	946	17,116	13,648	1,789	15,432	5,128	645	5,773	34,941	3,380	38,321	
1898-99 .	12,249	778	13,027	8,055	836	8,891	3,272	402	3,674	23,576	2,016	25,592	
1899-00 .	7,068	437	7,500	4,004	175	4,179	1,612	130	1,742	12,679	742	13,421	
1900-01 .	15,159	1,327	16,486	12,255	...	...	4,185	...	...	31,599	...	...	Crop rate total for Beawar and Todgarh not available.

1. *Q.* (*The President.*)—You are Executive Engineer of Ajmer and Merwara?—Yes.

2. *Q.* Are all the works under your charge?—Yes.

3. *Q.* Have you had charge long?—I have been in charge of this division four different times for about three years in all.

4. *Q.* Are you a Roorkee man?—Yes.

5. *Q.* Have you studied any projects for irrigation works in Ajmer? Do you know anything about the proposals for utilising rivers like the Banas?—I mention the Khari scheme in my statement; it affects the *Jetsmar* Estates.

6. *Q.* Your relief works were chiefly tanks?—Yes.

7. *Q.* Were sluices built in these tanks?—Yes.

8. *Q.* In every case?—Yes.

9. *Q.* That was not done from the famine fund, I suppose?—Yes; from famine fund.

10. *Q.* Can you tell me what proportion of the cultivable land of Ajmer District is irrigated or covered by irrigation?—The total irrigated area in Ajmer and Merwara is 38,470 acres.

11. *Q.* What is the total cultivable area in these two districts?—The total area of the Province is 731,578 acres.

12. *Q.* You have not got the cultivable area?—No. The revenue part of this report was done by the Revenue Department and anything that refers to revenue I know nothing about.

13. *Q.* Are you keeping up a programme of famine works?—Yes.

14. *Q.* How many people do you provide for?—The programme which has been got out provides for 89,846 people for the two districts.

15. *Q.* For how many months?—Three.

16. *Q.* You talk about 1st, 2nd, 3rd, and 4th class tanks. What do you mean?—For assessment purposes the tanks have been divided into four classes—

Class I.—Those in which the irrigated area pays either a crop rate, varying as the crop is grown or a special contract rate settled by agreement in lieu of the same.

Class II.—Those in which a standard area and a standard revenue have been fixed, and under which the land pays a rate which, within defined limits, varies in proportion to the area on which crops are irrigated or brought to maturity, and (when the supply for the spring crop runs short) as the number of waterings given to the field.

Class III.—Those paying an assessment fixed for a period of years and which are maintained by Government.

Class IV.—Those paying an assessment fixed for a number of years and which are repaired by the villagers.

17. *Q.* Have you any new tanks proposed for Ajmer?—No. You will see from the map that the whole catchment of both districts (Ajmer and Merwara) has been utilized.

18. *Q.* You cannot find any new sites for tanks either in Ajmer or Merwara?—No.

19. *Q.* What tanks have you got in the famine programme?—Improving and strengthening the dams of existing tanks.

20. *Q.* Do you ever employ famine labour on anything except on earth work?—Sometimes on dry stone masonry walls and also on concrete.

21. *Q.* Do they make a concrete wall throughout or do they employ other labour?—Solely by famine labour.

22. *Q.* You say in this statement that a certain quantity of water is left in a tank. Is that below or above the sluice level?—Below it.

23. *Q.* You don't empty the tanks every year?—In good years some water remains, but in others there is no water, which is very scanty here.

24. *Q.* I suppose your tanks don't fill in a bad year?—No. In a year of ordinary rainfall they fill with some exceptions.

25. *Q.* Have any of your tanks got water now?—Hardly any. There is a little in a few tanks. There is some water in the tanks in Merwara now but generally at this time they are all empty.

26. *Q.* (*Mr. Ibbetson*).—Have any tanks been made during the last ten years in Ajmer?—Yes.

27. *Q.* How many new tanks have been made?—28 in both districts, *viz*, 8 in Ajmer and 20 in Merwara.

28. *Q.* Do you keep up a return of the income derived?—The Revenue Department keeps that.

Pundit Sham Nath.

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TWELFTH DAY.

Ajmer, 23rd November 1901.

WITNESS No. 16.—MUNSHI IMAMUDDIN, Revenue Extra Assistant Commissioner, Ajmer.

In reply to *Mr. Ibbetson*, witness said—About ¼ of the cultivated area of Ajmer-Merwara is irrigated; about ⅔ of the irrigation is from wells and ⅓ from tanks. In the famine year half the usual area was irrigated from wells and ½ from tanks; there are 3 or 4 tanks which fill even with small rainfall and from these there was full irrigation.

2. There are four kinds of tanks, (1) irrigates both *fasls*, (2) gives only one or two waterings to the rabi, (3) gives a *paleo* watering only, and in (4) the beds only are sown. The effect of tanks in raising the sub-soil water is felt to ten *kos* and more; for instance the effect of the Kalinjar tank is noticeable at a distance of 22 miles.

3. Revenue Accounts are kept of the tanks which pay about 3½ per cent. The revenue includes water-rate, land revenue on bed, and miscellaneous revenue, such as fines. No share of the land revenue of tank-irrigated land is credited to the tanks; but one-fourth of the well area is credited. New cultivation is not credited. The tanks made in the last ten years (during famines) pay less than the older ones.

4. *Abi* is land in the bed of tanks and fields flooded by bunds; the latter are chiefly in Merwara. The extent of *abi* lands cannot be increased.

5. Small tanks cannot be extended without interfering with the catchments of Government tanks.

6. About one-fifth of the wells or 2,625 out of 11,555 get help from bunds. The average depth of water below ground is 20 feet or now, after dry years, 26 feet. Each well on an average irrigates 5 acres per annum. The difference in the revenue paid by unirrigated and by well lands is Rs. 3-8 per acre, or say Rs. 15 per well; a well costs Rs. 300; there are now as many wells as can be worked properly by the available labour. Trial borings have not been made; they would be very useful.

7. Some takavi was taken for tanks and a good deal for wells in the famine. There is no protective lease; and exemption from enhancement of revenue of lands on a new well is only given till next settlement. We begin the recovery after one year and recover the whole advance in 6 or 7 years. No remission is given for failures.

8. There are many *Istimraidars*; Government give them no assistance in irrigation; their people suffered most in the famine, because they have no transferable rights.

9. About 900 wells have been made in the last 15 years in Ajmer and 800 in Merwara; about ⅓ of the disused wells are repaired. The small area on wells is due to the absence of springs; they are percolation wells; generally there is only one pair of bullocks to a well.

Munshi Imamuddin.

23 Nov. 01.

WITNESS No. 17.—MUNSHI SHIB LAL.

Witness put in the following documents:—

1. Correspondence relating to Preliminary Investigation, Famine Protective Works, Jodhpur (Marwar) State printed below.

2. Annual Revenue Statistics for Marwar.

Munshi Shib Lall.

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Munshi Shib Lall.

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3. Statement showing the particulars of the Bunds in the State.

4. Statement of existing works in Jodhpur State.

5. Initial Statistics of Irrigation Works in the Jodhpur State.

6. Statement of proposed works in the State.

7. A map of the State.

No. F.B. 3—1271, dated 25th August 1901.

From—The Secretary to the Musahib Ala, Marwar.

To—The Resident, Western Rajputana States.

With reference to the correspondence ending with your office letter No. 3022, dated 15th August 1901, regarding the famine irrigation programme, I have the honour to inform you that the Durbar fully concurs with Mr. Home, who is of opinion that the irrigation works existing in the State are of unquestionable utility in years of tolerably good rainfall, but they are of no use as a protection against famine, as all of them being storage reservoirs are in themselves dependent on local rainfall and are empty or nearly so, in years of drought, as has abundantly been proved in the case of Jaswantsagar Tank which has a catchment area of 1,300 square miles, but did not receive a drop of water in the years 1898 and 1899, while during 1900, over 4,000 million cubic feet were impounded.

Investigation for the gradual construction of suitable works which, though they do not directly possess any protective value yet are held to be protective in ordinary years, are, however, being made, and the preliminary information asked for, which is being collected by Mr. Home, will be submitted hereafter. Under these circumstances the Durbar does not deem it expedient to trouble Mr. Manners-Smith for this purpose.

In reply to *Mr. Ibbetson*, Witness said—There is plenty of room for the extension of tanks in Jodhpur and four new tanks are now proposed. We have only one Nadi (Luni) of any size, rising in hills near Ajmer and flowing, fed by several tributaries in Marwar, down to the Rann of Kutch. If we build tanks over its several tributaries we reduce by so much the bulk of water in the main stream and thereby affect the irrigation (chiefly wells and inundation) in districts of Marwar. Thus bunds or tanks are seldom undertaken and even then not so much for irrigation as for providing suitable work for famine people in bad years.

2. The average depth to water is 30 feet in districts just below the Aravalli hills (locally Magra) while in sandy parts (locally called Thal) removed away from these hills and embracing the North and West of Marwar, is 300 to 400 feet. Barley, wheat and cotton are cultivated on 30 feet wells. Four pairs of bullocks working day and night irrigate 20 acres or 50 bighas yearly. They cost each well Rl,000 to Rl,500 and are worked by Persian-wheel or *mot*. According as the rains are scanty, the level sinks. Sinking of the 30 feet wells is greatly encouraged by Durbar, by money-advances and remission in assessment, but there is not much room for their extension in Khalsa villages The Thal wells are, from their great depth, and as great expenses, seldom used for irrigation. If at all used, they require sixteen pairs of bullocks to work one *mot*, which will irrigate 30 bighas of barley and a few local vegetables, a very meagre return for the working cost. They cost each R3,000 to sink and are not undertaken now-a-days. What exist are old ones.

WITNESS No. 18—PANDIT BRAHMA NAND, Superintendent, Land Revenue Department, Marwar.

Pundit Brahma Nund.

23 Nov. 01.

1. Q. (*The President*).—How long have you been in Jodhpur?—Twenty-six years.

2. Q. How deep are your wells?—For irrigation about 70 feet deep; drinking wells in sandy tracts are about 300 feet deep; these are not irrigation wells.

3. Q. How many wells have you?—54,000 altogether in Marwar, about 10,000 of these are in the *khalsa*; many of the wells are brackish.

4. Q. Brackish wells in ordinary years do good work, but not in a year of drought?—Yes.

5. Q. Since the famine have the people made new wells to preserve themselves against future famines?—They have dug a few wells.

6. Q. Are they digging more wells?—The number of wells has not increased remarkably because the present number is quite sufficient.

7. Q. You lost very heavily during the famine in Marwar?—Yes.

8. Q. Was any difficulty experienced as regards drinking water in the last great famine?—Yes, there was a scarcity of drinking water.

9. Q. Ar takavi advances given by the Durbar?—Yes.

10. Q. Do many men apply for these advances?—There is a limited number of applications, because those who are well-to-do don't apply for takavi.

11. Q. Is any interest taken for takavi?—No.

12. Q. In how many years do you get the money back?—Generally in 3 years, but it depends upon the means of the cultivators too. If they have good crops they pay back in one instalment. Last year we distributed takavi which would have been paid back by this year had it been a good one.

13. Q. Do you give takavi for making wells?—Yes, at 6 per cent. interest.

14. Q. What is the total culturable area in Jodhpur?—The total area is 35,061 square miles, of this 1,078 are wet and 33,988 are dry. Of the total area 3,112,141 acres are *khalsa* of which 1,732,814 acres are cultivated, 784,331 acres are culturable, 594,996 are unculturable, 142 329 acres of the former are under wet cultivation, of which 94,000 acres are under crop each year.

15. Q. How much of the 94,000 acres is tank and how much well?—4,826 acres under tanks and 89,174 under wells.

16. Q. There are not many tanks?—No, only 3 big tanks and some smaller ones.

17. Q. Is that all the tanks you have in Jodhpur?—Yes, all that are used for irrigation.

18. Q. What do you think should be done for Jodhpur to prevent suffering in another famine?—I can only suggest a canal from the Sutlej.

19. Q. Do they make bunds across the hollow places to catch the water?—Yes, we have made shallow tanks.

20. Q. If another famine came, could you do anything better?—Yes, we have projects now for several bunds.

21. Q. Have you got any programme of famine works?—Yes.

22. Q. How many men can you employ?—More than a lakh.

23. Q. For how long?—Nine months.

24. Q. What work can you give them to do?—Earthwork on making bunds.

25. Q. You calculate you could find work on bunds to occupy the population for nine months?—Yes.

26. Q. (*Mr. Ibbetson*).—You say that you have a very large *barani* area of cultivation and that more wells are not made because there are enough already. Why could not more wells be made so as to turn the *barani* area into *chahi*?—Because it would cost too much as the water is too deep; and it is quite impossible to sink wells in some parts; in other parts there are plenty of wells.

27. Q. You mean where wells can be made there are enough already?—Yes.

WITNESS No. 19.—RAI BAHADUR B. SINGHI JAWAHIR CHAND, Dewan of Sirohi.

Witness put in the following documents :—

1 Correspondence relating to Preliminary Investigations for Famine Protective Works, Sirohi State (printed below).

2. Statement of Existing Works, Sirohi State.

3. Statement of proposed Famine Protective Works, Sirohi State.

4. A Map of the State.

Rai B. Singhi Jawahir Chand.

23 Nov. 01.

No. 662, dated 13th October 1901.

From—The Dewan of Sirohi,

To—The Resident, Western Rajputana State.

In compliance with your No. 1850, dated 2nd May 1901, I have the honour to forward herewith as directed, a general report on the Preliminary Investigation for Famine Protective Works in the Sirohi State, together with a map of the Sirohi State, wherein are marked the sites of the existing and proposed irrigation works as per Appendices A and B, and also plans of the six of the proposed works as entered in Appendix B.

2. I beg to draw your special attention to paragraph 37 of the report wherein I have endeavoured to express the Durbar's views regarding the superiority of well irrigation in this State over tanks for the reason stated in the report and to paragraph 31 expressing the Durbar's desire that the Sirohi and Rohera tanks should be finished before any more works are undertaken.

3. The Durbar are very thankful to Mr. Manners-Smith Superintending Engineer on special duty, preliminary investigation Famine Protective Works, for the trouble he has taken in visiting the sites of the existing and proposed works for local investigation, and for the kind assistance rendered in preparing the map and the plans.

General report on Preliminary Investigation for Famine Protective Works in the Sirohi State.

Area.—The estimated area of the Sirohi State is 3,020 square miles. It is bounded on the north by Marwar or Jodhpur, on the east by Meywar or Udaipur, on the south by Palanpur and Mahikanta States of Idar and Danta, and on the west by Jodhpur.

2. *Physical aspect.*—The country is much intersected by hills, and rocky ranges, Mount Abu being the main feature, situated at the extremity of the Aravelli Hills. That range divides the State into two portions; the western portion which is comparatively open level spreading out to the plains of Marwar is more thickly populated and better cultivated than the eastern portion.

3. *Divisions.*—The State is divided into 12 tahsils for Revenue Administrative purposes.

4. *Population.*—The population of the whole State according to the census of 1891 A.D. was 190,886 persons, of which 33,151 was composed of Bhils, Grassias and Minas. The population according to the late census is 154,514 persons, of which 18,126 are Bhils, Grassias and Minas.

5. The late census shows a decrease of 36,292 souls as compared with the total population under the census of 1891. The decrease is due to the effect of the late famine and prevalence of cholera and malarial fever, which followed close upon the late famine.

6. *Villages.*—There are 413 villages and towns, of which 145 are Khalsa and 268 are under Jagirs and charitable institutions. In the Jagir villages, however, the Durbar is the proprietor of a share varying from one-fourth to three-fourths of the whole produce.

7. *Revenue.*—The average annual land revenue for the five years preceding the famine amounted to Rs. 4,01,128, of which Rs. 2,20,769 were realized from *rabi* winter crop, and Rs 1,83,359 from the monsoon or *kharif* crops, of this total Rs. 89,128 were realized in Khalsa villages, and Rs. 3,15,000 from the villages under the Jagir and the charitable institutions.

8. In the Khalsa villages the revenue realized in the famine of 1899-1900 amounted to Rs. 4,506 from *kharif* crops and Rs. 24,755 from *rabi* crops.

9. A large quantity of the land in Khalsa villages does not pay any revenue for the *kharif* crops, as it is granted to "Pasaitas" and menial classes free of any revenue assessment in consideration of past and present services to the State.

10 The average area of land brought under cultivation is 39,000 bighas of land (222,857 acres), of which 9,000 bighas produce *rabi* crops and on the remaining 30,000 of land only *kharif* crops are raised.

11 The ratio of culturable land to the total gross area of the State is 1 to 12, and the ratio of irrigated land to the culturable land is 1 to 4.

12. Neither the Khalsa nor the Jagir villages have been surveyed for revenue settlement. The figures of irrigated and other culturable land are in consequence approximately estimated.

13. In the tahsils, three systems of revenue collection are in force For some of the land a certain fixed quantity of grain per bigha is levied, which is not affected or modified, according to the gross produce; for others a fixed share of the gross produce is realized, and there is also some land which is assessed at a fixed sum of money per every bigha.

14. *Rainfall.*—The average rainfall of the Sirohi State excluding Abu for the eight years ending December 1898 is 23·67 as per statement below :—

1891	16·85
1892	37·12
1893	42·11
1894	25·55
1895	13·9
1896	20·0
1897	20 16
1898	14·6
Total	189·39
Average	23·67

15. In the famine year of 1899 the total rainfall was only 5·75 whereas in 1900 it was 26 50. The rainfall recorded up to date this year is measured at 5·51, and it is presumed that there are no prospects of any more. Hence in this year too, there is a great deficiency of rain.

16. *Produce.*—The gross annual produce of staple grain in the whole State in a normal year is 900,000 maunds, and at the rate of 5 maunds per head per annum, there is a gross consumption of 772,720 maunds. This shows a surplus of 27,280 maunds in an ordinary year. In exceptionally good years the annual production of grain in the State is much larger than its requirements and the surplus is partly exported and partly stored up.

17. *Previous Famines.*—The famine of Samwat 1925 (1869 A.D.) was severely felt in Rajputana, but in Sirohi the people were not so severely affected as elsewhere in Rajputana, as there was an outturn of 6 and 8 annas in the rupee in *kharif* and *rabi* crops respectively. Also grass and other fodder was in abundance and there was no mortality among the cattle.

18. The next famine was in the year 1878 A.D. There was an outturn of 6 annas only, but the prices of staple grains rose very high, owing to the great scarcity elsewhere. The poor classes suffered much.

19 The last famine was that of 1899. The great scarcity of grass and fodder was unknown in the previous famine. Cattle perished from starvation in great numbers. In the beginning the grain was quite sufficient to support the people for seven or eight months, but according to the practice of this State their stock was deposited with the Bohras, who refused to make them any advances on the prospects appearing gloomy. Relief works were, however, opened and poor houses started in time, and the Durbar used every means in their power to mitigate their sufferings.

Irrigation Works.

20. *Tanks.*—Although there are plenty of village tanks, these are simply for the water-supply of the villages and cattle, and are not used for irrigation, nor are they large enough nor have they sufficient catchment areas, for this purpose.

21. There are at present only two tanks, which have been constructed for irrigation (as shown in Appendix A).

(1) Chandela at the foot of the Abu Hill and 8 miles from Abu road. It was an old tank, which was enlarged and improved in the late famine and which has now a capacity of 11 million cubic feet and can irrigate 675 acres.

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(2) The Diamond Jubilee Tank at Pindwara, which was constructed in honour of the Diamond Jubilee of the late Queen Empress Victoria. The work was carried out by the Executive Engineer, Mount Abu. The capacity of the tank is 56 million cubic feet, and this should be sufficient to irrigate 560 acres, but unfortunately though the tank filled in 1900-1901, there was extensive leakage through the hills between the two dams. Steps were taken this year to prevent the leakage, but owing to the deficient rainfall this year the tank has not filled, and it has not been possible to see if the work is efficient or not, and the value of the tank as an irrigation work is still unsettled.

22. Besides these a new tank was started at Sirohi itself in the famine, but the work has been stopped till the plans and estimates have been further investigated and checked.

23. At Rohera the foundations for the dam of the tank were also dug in the famines.

24. On the Sirohi Tank Rs. 60,895-9-3 was expended in the famine and Rs. 11,687-1-0 was spent since the late famine.

25. On the Rohera Tank Rs. 14,881-2-9 was expended during the famine and nothing since famine.

26. On the Chandela Tank Rs. 17,053-2-0 was expended during the famine, and Rs. 7,706-14 6 since the famine was over.

27. On the Pindwara Tank Rs. 47,766 has been expended, but as its construction was carried on under the supervision of the Executive Engineer, Mount Abu, the actual amount expended during famine cannot be stated.

28. The tanks at Rohera and Sirohi are included in Appendix B, appended herewith.

29. Besides these, owing to the hilly nature of the State there are many excellent sites for constructing good tanks by damming up the rivers where they pass through gorges in the hills, but these have never before been considered. Mr. Manners-Smith, Superintending Engineer, Famine Protective Works, has now inspected the sites of the following and rough surveys of the same have been made. The information regarding each with the approximate cost of construction and the land that can be irrigated by them are shown in Appendix B.

Radhor and Dhonta, Velangri, Poidra site south of Chandela at the foot of the Abu hill.

30. These have all large catchment areas varying from 10 square miles to 90 square miles and the tanks formed will have capacities from 50 million cubic feet to 450 million cubic feet, and they should be all really useful irrigation works, the larger one of some protective value.

31. It is hoped that detailed surveys and plans for these projects may be prepared as they will be of the greatest help to the State, whenever it may be able to carry them into execution or should another famine occur, for all the works could be executed for the greater part by famine labour. It is proposed to continue work on the Sirohi and Rohera Tanks as soon as these detailed surveys are received and the funds required are available.

32. *Well irrigation.*—At present all the irrigation in the State is carried out from wells and they are 5,157 in number, the area irrigated by them is approximately 75,000 bighas, which gives an average of 15 bighas per well. The average revenue derived from well irrigation is Rs. 1,83,975 per annum.

33. In the famine year of 1899-1900 nearly 40,000 bighas of land were irrigated from wells and the approximate revenue derived was Rs 50,000.

34. A great portion of the crops produced in the famine year was used in preserving the agricultural cattle, and the actual production was greater than the revenue realized. The quantity of Raj share collected was not very great, but the proportionately large sum of Rs. 24,755 was derived owing to the high prices which prevailed at the time.

35. The cost of sinking a well and constructing masonry works in it varies from Rs. 300 to 1,500, Rs. 800 may be taken as the average cost of a well.

36. It is thought that the number of wells is at present sufficient for the cultivators in the State. As a protective measure, however, against famine the Durbar have been trying their best to increase the number of wells by sinking new wells in places wherever there is a demand for them and where there is sufficient land near at hand to be irrigated by advancing funds and rendering any other assistances necessary.

37. There are some manifest advantages from irrigation by wells. They are useful for irrigation even when there is deficient rainfall, whereas tanks are dependent on the rainfall. They are comparatively cheap to construct, while tanks are very expensive and are only really protective, if they are capable of holding a two years' supply of water.

38. *Other forms of irrigation.*—In addition to irrigation by wells in places where hill streams exist, water is taken by "Saru" to irrigate fields and the area irrigated by such means is 15,000 bighas.

39. In some places the cultivators also make "Tals" to hold up the rain water in the fields and when these dry gram and barley are grown in them. When there is good rainfall 5,000 bighas of land are cultivated in this way.

40. Of the rivers in the State all excepting the Banas cease to flow soon after the rains.

Wells are sunk near the banks of these rivers and water is drawn from them to irrigate the fields on their banks. But these wells are useful only a month or six weeks after the rains, as after that they dry up and no water is found in them even if deepened. These wells are very often useful merely to keep alive the withering *kharif* crops on the banks.

41. As in the short time available, it has only been possible to make rough surveys and approximate estimates of the proposed works, noted in Appendix B, it is absolutely necessary before undertaking works of their magnitude that further investigations be taken as to their protective and remunerative character and permanent advantage, and if the strata of the hills surrounding the proposed tanks can be relied on against leakage.

42. A map of the State showing the sites of the existing and proposed works as per Appendices A and B and also plans of six of the proposed works, as entered in Appendix B are herewith enclosed.

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1. *Q* (*Mr. Ibbetson*).—You say that the Durbar has been sinking new wells, are the wells made by State Agency or does the State merely advance the money?—The State advances money to sink wells. It also induces the money-lenders to advance money in some cases by guaranteeing repayment by the borrower. In a few cases wells are also made by State Agency, and in some cases State does not take Hasil from the rayats for some years for sinking wells by them.

2. *Q.* What are the chief crops grown in the State on tanks and on wells?—The following chief crops are grown by irrigation in the State on tanks and on wells:—

(*a*) *Kharif crops.*—Maize or Indian corn, kara, chola, cotton pods, jowar, bajri.

(*b*) *Rabi crops.*—Wheat, barley, sarson, krang, methi.

3. *Q.* You say that about 5,000 bighas (about 2,857 acres) have been embanked by making small bunds, could the area be extended?—The area embanked by making bunds is possible of extension, but much depends upon the yearly fall of rain, on which the growing of crops on land embanked by small bunds is dependent.

4. *Q.* What is the average area irrigated by a well during the year?—It is estimated that on an average 15 bighas (about 8½ acres) of land are irrigated by a well.

5. *Q.* On what terms does the State advance money for wells as regards interest, period allowed for repayment, exemption from enhancement, etc.?—Interest varying from 6 to 12 per cent. per annum is charged for advances made for well sinking. On advances on which the interest is 6 per cent. or less per annum, the interest is invariably to be paid every year. In other cases no more interest is charged when the principal is doubled by addition of interest. In repayment of the original sum advanced either ⅓rd, ¼th or ⅕th of the gross produce is yearly recovered. In cases in which money-lenders are made to make advances to sink wells the same system of repayment holds good. If the cultivators be other than those who sank wells, some share is also taken from them till the amount is fully realized. In view of the agricultural outlook and other circumstances of the year, the Durbar share of the grain produced by irrigation is subject to variation.

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hill to the Dhikola Fort hill, the dam following the course of the natural ridge eventually joins the Nowgaon Hill.

The catchment area is about 100 square miles. It is a flat country mostly lying uncultivated.

With an average rainfall of 24 inches and 10 per cent. run off, we get.—

$2\frac{1}{2} \times \frac{24}{10} \times 100 = 560$ m. c. ft. as the amount we may assume as available for storage.

The superficial area of the water spread at R. L. 46500, is $17000 \times 7200 = 122,400,000$ square feet, and the depth of the water is=15 feet, therefore the capacity is $122,400,000 \times \frac{16}{3} = 612$ m. c. ft. This is in excess of the storage required, and probably the weir level should be fixed at R. L. 464.

Now one bigha is 27,225 square feet and there are 1,024 bighas or 640 acres in one square mile.—

Assuming that 100,000 cubic feet of water will suffice to irrigate one acre allowing for evaporation, etc., we get the total area that can be irrigated by the aforesaid quantity of water $\frac{560 \text{ m. c ft.}}{100000}$ 5600 acres or 89,60 bighas. The dam will be 18,000 feet long (including, the Dhikola Fort Hill) and Mr. Manners-Smith recommends another dam with core wall from the Nowgaon Hill to the Dhikola Hill and northwards of Dhikola an earth embankment is proposed. For the type see the plans attached.

The main waste will be near the Nowgaon hill. The length required with 3 feet flood discharge to pass the maximum flood is 1,300 feet.

It is proposed to have three sluices with irrigating canals leading from them at different points on the bund.

The approximate cost of the project is estimated at Rs. 27,500 and taking the water cess at the rate of Rs. 3 per acre on 5,600 acres, which can be irrigated from the tank we get Rs. 16,500 as the revenue derived *i. e.*, 13 per cent. on the total outlay. The lands of the following villages will be irrigated from the tank :—

1 Dhikola.	6 Bidesra.
2 Nowgaon.	7 Bhimpura.
3 Kai.	8 Sioni.
4 Raghu Nathpura.	9 Gyanji-ka-khera.
5 Doulatpura.	10 Shahpura.

II.—Thandal-Surajpura Project.

The proposal consists of bunding the Nallah passing between Surajpura and Thandal villages. The source of the nallah lies in the Udaipur territory.

The catchment area is about 114 square miles and the water available for storage allowing 10 per cent. of rainfall would be $2\frac{1}{2} \times \frac{24}{10} \times 114 = 638$ m. c. ft sufficient to irrigate 6,380 acres or 10,208 bighas.

From the contour taken at R. L. 457 the capacity of the reservior is approximately $104 \times \frac{18}{3} = 624$ m. c. ft and this may be taken as weir level. The dam proposed is of the same type as that for Dhikola project, *viz.*, an earth embankment with core wall for 8,000 feet in the centre portion and earth embankment for the rest, the total length being about four miles.

The maximum flood discharge to be provided for, is 28,875 c. ft. per second and with a 4 feet depth of flood, the length of weir required is 1,030 feet. Taking the water cess at Rs 3 per acre we get Rs. 19,140 a year on 6,380 acres or 10,208 bighas which can be irrigated at 6 per cent on the total cost of Rs 3,07,000 which is roughly estimated.

The lands of the following villages will be irrigated from the tank :—

1 Surajpura.	8 Rup Pura.
2 Thandal.	9 Dailana.
3 Nimbahera.	10 Sankhtra.
4 Shahpura.	11 Hanotra.
5 Nawada Khera.	12 Rani Khera.
6 Arnia.	13 Dhoktra.
7 Mataji-Ka-Khera.	

* *N. B.*—The reduced levels are taken from the contour level of the State. R. L. 5 0 being taken as the level of the highest contour line on north-west corner of the State.

III.—The Mansi Irrigation Project.

The site is situated at a distance of quarter mile from Arur and 15 miles north-west of Shahpura. It is proposed to throw a dam across the Mansi River and to make a big reservoir for the storage of water. The river has its sources in Udaipur territory. It joins the Khari River near Phulia.

The catchment area of the river at the site proposed is about 400 square miles. The soil is of mixed character of a rocky sandy formation. The land to be irrigated is for the most part first class.

With an average rainfall of 24 inches and the run-off of 10 per cent. we get the total quantity of the water available for storage as $2\frac{1}{2} \times \frac{24}{10} \times 400 = 2,245\frac{5}{8}$ m. c. ft.

From a contour taken at R. L. 465·00 the reservoir will hold 2,040 m. c ft. but as the water at this contour spreads into Udaipur territory it is proposed to take R. L. 457·00 as our weir level. This will approximately reduce the capacity of the tank to 1,500 m. c. ft., sufficient to irrigate 15,000 acres or 24,000 bighas.

The dam proposed is a curved one nearly four miles in length taking Arur and Diana villages on its bank. The type of the dam will be exactly the same as in the Dhikola Project. The difficulty will be the weir, as to pass maximum flood on this large catchment with a 3 feet head, a weir 4,000 feet in length is required. The approximate cost is estimated at Rs. 3,25,000 and the revenue derived at the rate of Rs. 3 per acre on 15,000 acres, that can be irrigated is Rs. 45,000 or nearly 14 per cent. on the cost.

The following villages will be irrigated from the tank :—

1 Arur.	5 Dalvaria.
2 Diana.	6 Bari Kanaschan.
3 Nathadiwas.	7 Choti Do.
4 Panotia.	8 Taswaria.

III.—Kothian-Khari River Project.

It is proposed to build a masonry weir across the Khari River on the extreme border of the State about a mile distant from Kothian in the north-west direction, and from it a canal will be constructed which will command 7 square miles of land or 4,500 acres or 7,000 bighas. This will be an immense benefit in years of scarcity as the Khari is a big river, 289 feet broad at the site of weir and having catchment area of about 898 square miles at that point. The river has its source in Udaipur territory near Deogarh.

Maximum flood discharge by Dickinson's formula= 135,500 c. ft. per second. The weir is proposed to be built about 6 feet in height from the bed of the river, and it is proposed to use shutter openings to allow the flood water to pass freely without overflowing the banks, and to keep the bed clear. No sooner is the rainy season drawing to a close than the shutter openings will be closed. The weir will be 350 feet in length. A canal with proper head sluices is proposed to be taken from the south bank towards Kothian and Sangaria villages and the Mansi reservoir.

The approximate cost is estimated at Rs. 31,500, so that the work should give a very large profit.

As above stated the river forms the boundary between the Shahpura and the Ajmer territories, and both Udaipur and Ajmer have claim to the water in their own territories so that the work cannot be carried out until some agreement is made, as they very probably will have schemes of their own from the river.

If we neglect the Khari River project for the present the result that may be expected by carrying out the other three works is :—

Name of Projects.	Cost.	Area that can be irrigated.		Revenue derived.	Profit.
		Acres.	Bighas.		
	R				%
Dhikola . .	1,27,500	5 600	9,000	16,800	13·18
Thandal . .	3,07,000	6,400	10,000	19,200	6·25
Mansi . .	3,25,000	15,000	24,000	45,000	13·8
Total . .	7,59,500	27,000	43,000	81,000	10·07

At present 44,000 bighas are cultivated in the State from wells and tanks, so the area will be practically doubled.

The estimate and surveys on which these figures are based are at present approximate, but they show that the work will not only be profitable to the State, but of protective value and all are works on which famine labour could be usefully employed. When detailed surveys or estimates are prepared and the works thoroughly investigated it is hoped that the cost may be reduced.

Kachola Pargana.—This is a Jagir in the Udaipur State consisting of scattered villages each with its own little tank and wells, from which they irrigate their fields and obtain their water-supply, but no irrigation scheme can be proposed or carried out there, as Meywar Khalsa land interferes. In the last famine two tanks near Berwas and Mola, respectively, were constructed, but they are incomplete, and will be completed now. Statement A gives the number of tanks and information connected with the same. There are about 2,500 wells, but these are dry for the most part in a year of drought. The total area of the pargana is 343 square miles approximately and 1850 bighas is the average area irrigated in a normal year. The population, 1891, was 26,000 and from the figures of the last census is now only 12,000.

Shah Bhopal Singh.

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APPENDIX C.

Statement showing approximately the land cultivated, the production and the revenue derived therefrom each in good and bad years.

Land cultivated in bighas.

Bad year.		Good year.	
Kharif.	Rabi.	Kharif.	Rabi.
7,920	3,960	44,000	18,000

Total Production in maunds.

Bad year.	Good year.
Kharif and Rabi.	Kharif and Rabi.
53,000	496,000

Revenue derived both by the Raj and the Jagirdars.

Bad year.	Good year.
Kharif and Rabi.	Kharif and Rabi.
Rs. 31,000	Rs. 321,000

In reply to *Mr. Hutton* witness said.—Our tanks are dry when there is rain. In the famine year half of them got water and filled; there was enough water for kharif but not for rabi; they were ¼ less useful than in an ordinary year.

2. A *charas* will irrigate about 3½ acres in a year; the sub-soil water is 20 to 30 feet deep; takavi for wells is given free of interest; usually 5,000 to 10,000 rupees are advanced each year; in the famine year Rs. 25,000. Advances are usually recovered in three years; in the famine seven years were allowed.

Witness No. 21.—Bohra Megh Pan, Dewan of Bundi.

Dewan of Bundi.

23 Nov. 01

Witness put in the following documents—

1. Correspondence relating to Preliminary Investigation, Famine Protective Works, Bundi State (printed below.)
2. Statement of Existing Works, Bundi State.
3. Statement of proposed works, Bundi State.
4. One Map of the State.

No. 227, dated Bundi, 19th October 1901.

From—The Council, Bundi State,

To—Captain F. B. Prideaux, Political Agent Harati and Tonk.

Bundi State.

General.—The State of Bundi (Rajputana) is bounded by the States of Jaipur and Tonk on the north, by Kotah on the south and east, and by Udaipur on the west. The country is divided into two portions by a double range of hills, called the Ara Bala Hills running from north-east to south-west. On the north of these hills the country is for the most part hilly and rocky and on the south it is flat plain. The Chambal River is the boundary between Bundi and Kotah on the south-east, but after this the chief river in the State is the "Mej," which rises in the Meywar territory and after a winding course of about 90 miles, within the Bundi State territory, falls into the Chambal River at a point between Sonpur and Pali villages of Bundi. The area of the State is 2,220 square miles. The population in 1891, 295,675 persons; in 1901, 171,227 persons. There are in all 930 villages in the State, out of which 634 are Khalsa and 296 Jagir.

Rainfall.—The rainfall recorded during the past ten years is as follows:—

1891-1892	11·0
1892-1893	17·50
1893-1894	15·0
1894-1895	28·0
1895-1896	22·25
1896-1897	20·80
1897-1898	20·45
1898-1899	17·51
1899-1900	13·9
1900-1901	41·83
Total	207·43

Average for one year 20·74.

The rainfall this year is again deficient and registered only about 17 inches.

Area cultivated.—The total quantity of culturable land in the State is approximately 800,000 bighas, out of which about 700,000 bighas is cultivated in ordinary years producing about 20,00,000 maunds of food grains. The amount of grain estimated to be required for local consumption at 9 maunds per head of present population, is 15 lakh maunds. To this a reserve of five lakh maunds should be added as a protection against famine or 20 lakh maunds in all is required. It will be noticed that only about ¼ of the whole State is culturable land, the remainder being hilly and rocky. Of the 700,000 bighas cultivated only 100,000 is irrigated land.

Revenue.—The average land revenue is about Rs. 500,000 in normal years, and in 1899 or the Famine year it was about Rs. 2,00,000 of which 1½ lakh was realized from irrigated land.

Irrigation Works.—Tanks.—There are in all 125 tanks (including weirs across streams) in the State (see Appendix A), but of these, at present, only two are real irrigation works, viz., Hindoli and Dugiori. Of the remainder 14 are out of repair and breached, but if repaired and improved they would also be useful for irrigation.

Rumja, Bhawanipura, Kherapura, Deogi, Talwas, Lakheric, Gaindoli tanks, (2) Dabi, Palkan, Gararda, Ganwar, Selar, and Kanwarti.

The remaining 109 are only village tanks, useful for drinking purposes of the villagers and their cattle, and in the beds of some of them a crop is grown, but they have only small catchment areas and could never be of any use for irrigation or of any protective value.

The Hindoli tank has a catchment area of about 18 square miles and a capacity of about 90 million cubic feet. The exact quantity of land irrigated from the tank is not known, but in the famine year, this tank never quite dried and was of great protective value, both by direct irrigation and for crops grown in the bed when the water dried. The irrigation from this tank could probably be improved if the ducts were properly laid out; and its inspection by the Superintending Engineer would be useful. The Dugari Tank has a catchment of 35 square miles and a capacity of about 160 million cubic feet. This tank was also of the greatest value during the famine, but as it belongs to a Jagirdar it brings no direct revenue to the State. If the

Dewan of Bundi.

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ducts are improved and properly set out, Khalsa land also could be irrigated and it would be useful for these also to be inspected.

Wells.—With the exception of the two tanks noted above all the irrigated land is by wells, or nearly 100,000 bighas. The average allowance that a well can irrigate is 10 bighas, so there are at least 10,000 wells in the State or on an average 11 per village. The average cost of sinking a well in the State is Rs. 400. In the famine year a great number of the wells dried in the hilly portions of the State.

Rivers.—After the "Chambal" the "Mej" is the chief river in the State but the "Byaw" river which flows into the "Mej" north of the "Ara Bala" is also a big stream, and on the south of the Ara Bala another big stream the "Kural," flows from west to east eventually falling into the "Mej." The Mej and Byaw flow in deep banks and are not of any value for irrigation in their present condition, but across the "Kural," weirs have been locally built in several places, forming pools and here the water is raised by "Charas" to the fields, but the area so irrigated is small.

Proposed Works.—For protective works we must go to the big rivers and the following projects are proposed and require further investigation and these have been inspected by Mr. Manners-Smith, Superintending Engineer, Famine Protective Works—

(*a*) The construction of a dam across the gorge between the hills at Khatkar through which the river "Mej" flows.

(*b*) A canal project from the Chambal river starting from Gamach near Patan, the canal following the watershed *vid* Arnetha, Borda, Bangharli, and rejoining the Chambal near Makida opposite Gaisi.

Appendix "B" attached gives all the information collected by the Superintending Engineer, Famine Protective Works, on the above subject.

The Khatkar Lake will without doubt be of great value; and if after further investigation the Chambal canal is found feasible and can be carried out, the southern portion of the State will then be fairly secure against famine. Another project in the south portion of the State is suggested, and it is hoped that it may be inspected and if found worth further investigation surveyed in the cold weather, *viz.*, a dam across the Burda river between the village of Gagos and Antiawas.

The site is reported as suitable and the river has a very large catchment. This has been included in Statement "B," which gives all information at present available on the proposal. For the north portion of the State damming the river, "Byaw" near Bundi-ka-Gothra would be of great value as there is plenty of land below in need of irrigation. (See Appendix B).

Also at Pai and Balapur there is a "Nallah" which could be dammed, with a catchment area of 24 square miles and if a tank was formed here this would be of value to the State.

Both these sites may, it is hoped, be also inspected in the cold weather by the Superintending Engineer, Famine Protective Works; and if considered suitable, plans and estimates for the projects prepared.

A map of the State (4 miles to 1 inch) in which the sites and catchment areas of these works are shown, is attached.

In reply to *Mr. Ibbetson*, witness said—The State has to take loans to enable it to make tanks; all our large tanks are old; lately we have made only small tanks; since the famine we wish to make more tanks.

2. There are 10,000 wells in Bundi; the average depth to water is 60 feet; and the average cost of a well Rs. 400; they could only be worked for half the day during the famine. Two and three quarters of our bighas make an acre.

3. Takavi is given, for seed not for wells, where there is no local banker. We charge 6 to 12 per cent., which is less than the local banker's charge.

4. The proposed new tanks will irrigate chiefly in the Khalsa, though in our State the *Khalsa* and *Jagir* lands receive the same consideration.

Babu Munna Lal.

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WITNESS NO. 22.—B. MANNA LAL, Muatamid, Partabgarh State.

Witness put in the following documents:—

1. Preliminary Investigation Report on Famine Protective Works, Partabgarh State (printed below.)

2. Statement of Existing Works, Partabgarh State.

3. Statement of rivers and rivulets flowing through the State.

4. Statement showing the number of wells in use in the State.

5. Statement showing the number of wells that could be undertaken under the Famine Protective Programme.

6. One map of the State.

Report on preliminary investigation regarding irrigation in connection with Famine Protective Progamme, in the Partabgarh State.

Country: its situation and area.—The State of Partabgarh is bounded on the north by Udaipur and the Malwa Agency States; on the south by Piploda and Rutlam; on the west by Banswari and on the east by Mandsaur, a subah of Gwalior territories. The area of the State is 1,450 square miles: half of this being hilly and covered with forest, interspersed with tracts of level land which grow wheat and opium crops. Sisum and teak trees grow in the forest while sandal is not uncommon. The hills furnish excellent grazing ground for cattle, practically all the year round, and very often the Bhil gets rid of the extra grass by setting fire to it and thus makes room for fresher growth.

The soil is mostly black soil and it is on this that the poppy plant thrives. The soil in the southern and the western portions is sandy and furnishes beautiful fields for food grains. The irrigation is mostly dependent on wells which are not very deep as regards water level and are consequently comparatively cheap.

Population.—The population as ascertained in 1901 is 52,025 as against 87,975 of 1891. The number of Bhils in the recent enumeration was 11,513 as against 26,705 of the previous one. This may appear to be a sudden drop in the population, but an explanation may be sought in the more exact enumeration of the last census, although a considerable reduction of the Bhil population may be put down to the recent famine, in spite of relief which was freely given.

Number of villages, Khalsa and Jagir, Dharmada.—The total number of villages is 303 Khalsa, besides 546 Dharmada and Chakrana ones.

Revenue.—In a normal year when rainfall is not deficient, the amount of land revenue is 2,60,000 Salam Sahis. But during the recent famine, the like of which has never occurred in this State for the last hundred years, the net revenue derived was 42,000 Salam Sahis.

Average area under cultivation.—The average area of land which is annually brought under cultivation is 141,150 bighas, of which tanks feed 205 bighas, odis 1,800 and wells 10,690, while the rest depend upon rains for moisture.

The average annual produce of grain amounts to 397,130 maunds as against a consumption of 397,080 maunds.

The number of persons for whom relief would be necessary in time of famine may be put down at 13,000, for in 1899-1900 nearly 20,000 persons were relieved.

Average rainfall.—The figures for annual rainfall from 1891 have been as below:—

	In cents.
1891	32·26
1892	42·23
1893	63·62
1894	34·78
1895	29·27
1896	27·38
1897	27·48
1898	32·56
1899	10·88
1900	45·54
1901	14·78

or including the two bad years, 1899 and the present, an average of 32·79".

Causes and extent of suffering in the Famine.—The cause of the famine of 1899-1900 in this State, as in other States, was the failure of the monsoon. In the beginning, the rains had promised well and *kharif* sowings were completed without any misgivings. The crops had advanced promisingly when the rains suddenly ceased thus reducing the produce to 1 anna in the rupee.

However, there was a good produce of grass and this enabled the State to save a great number of cattle.

The loss of human life was great and the Bhil population suffered heavily. As is often the case, scarcity of food was followed by cholera and fever which thinned the population still more.

Inasmuch as the State of Partabgarh has enjoyed a long immunity from deficient rainfall, neither the State nor the cultivators have ever thought of any big scheme of irrigation. Such works as are in existence are mostly of an ornamental nature. The people have more faith in wells and they are right too. For there are hardly any sites where big irrigation works are possible.

Under such circumstances naturally wells are more practicable, and since they do not cost as much as they do in other parts of Rajputana, the chief and proper way of ensuring against years of drought is multiplying the number of wells.

Existing Irrigation works.—Forms (1), (2), (3) and (4) are herewith appended which contain such technical information regarding existing irrigation works as could be obtained regarding them.

Proposed works.—As has been explained above, the country furnishes very few sites where any fresh irrigation works could be undertaken and where irrigation on an extensive scale could be done. *Babu Munna Lal.* 23 Nov. 01.

The only site for large tanks which look feasible are :—

(*a*) Near Dotar in the Aairoo River where nearly 15 miles of catchment area may be available to supply the tank with water.

And taking the rainfall at an average of 33 inches, the amount of water in the tank could be estimated to irrigate 1 000 acres. But there is not much land below the site which could be brought under irrigation; still the tank would benefit the general water level of wells in and about Partabgarh apart from its being a useful source of water-supply in times of need.

(*b*) The only other site for a large reservoir may be possible near Phuldan. This would command a catchment area of nearly 40 square miles, and the quantity of water available for storage would be sufficient to benefit 3,000 acres of land.

In addition to these sites, the system of rivers in the eastern side of the State could be made to irrigate considerable areas, if masonry rapats could be built at suitable sites to hold up the water which would then be raised by wheels and oddis on to the fields.

As regards the number of wells that could be advantageously made in connection with the programme under consideration, a list is herewith attached.

The map which accompanies this report shows all the existing works in red, new sites are shown in blue surrounded by green.

In reply to *Mr. Ibbetson*, witness said as follows :—

1. The soil is usually black but in some portions it is also brown and reddish.

2. When such soil is brought under cultivation and watered by wells, etc., is named Adan. Manure is used for Adan soil and grows opium, wheat, gram, and rice, maize, etc.

3. Malete is a name given to the soil, the cultivation of which solely depends upon rains and grows wheat, gram, linseed, cotton and maize, etc.

4. There are 2,110 wells altogether and 6,248 acres of land is watered by wells and tanks.

5. There are 32 tanks, of which nine are used for irrigating 102 acres of land, and the rest are not used for crops at all.

6. In the late famine 1,316 acres of soil was brought under cultivation and watered by wells, and all the tanks were almost dried up.

7. Such a terrible famine never occurred in this part of the country before.

Mr. Manners-Smith recently inspected a few sites in the State and he came to know that if these two places were prepared, they may give relief to the people in case of another drought.

It is possible that there may be more sites for irrigation works, if an expert be deputed to go round and inspect the country.

Two sites recently inspected by Mr. Manners-Smith are :—

(I) Near Dotad. This place if bunded up can supply 1020 acres of culturable land with water.

The other is at Phuldan which may supply water to 1,650 acres (the above given areas are calculated from the map and not by actual measurement). It is not possible to say what the cost of these works would be : because no estimate is ready to hand ; however, it is a question whether the State can afford to undertake them in its present condition of finances.

8. A goodly number of new wells was dug during the famine of 1900 and most of the old ones were cleared and deepened. It will be very useful if the number of wells in the State could be multiplied, for the water level is generally reached by digging only about 22 feet below the surface. The cultivator can almost always depend upon his well and wells in a way secure him against famine : for he can always raise a crop of food grains when there is a well to feed it.

9. For small works the Durbar gives takavi. If the cultivator makes an Istimrar well himself we charge no revenue for the Adan only for five years. The period is two years if the money is borrowed from the State, and from the third to fifth year it is gradually increased ; the advance is recovered in two or three years.

Witness No. 23.—Mr. F. A. C. Manners-Smith, Superintending Engineer.

Witness put in the following documents :—

1. Preliminary Investigation Report for Famine Protective Works for Rajputana (printed below).

2. Statement A, Rupnagar Valley. Rainfall and River discharges with report, No. 166 of 5th November 1901.

3. Statement B, List of Irrigation Works proposed for the Karauli State.

4. A Tracing of proposed Banas Canal Project.

5. Correspondence relating to Preliminary Investigation, Famine Protective Works, Dungarpur State. (Printed below).

6. Statement of Existing Tanks, Dungarpur State.

7. Statement of Proposed Works, Dungarpur State.

8. One map of the State.

Preliminary Investigation, Famine Protective Works, Rajputana. *Mr. Manners-Smith.* 23 Nov. 01.

On receipt of Government of India Resolution No. $\frac{3}{61-1}$ F., of 13th March 1901, the Residents and Political Agents of all the Rajputana States were asked to take the steps described in paragraph 6 (1) of the Resolution, and to submit their Reports by the end of September 1901.

2. In June, on receipt of Mr. Higham's memorandum, which accompanied letter No. 547 C. W.—I., of 7th May 1901, from the Government of India, Public Works Department, amended orders were issued to embrace the more detailed demands of that circular.

3. Of the 20 States, 8 with Engineers of their own arranged for the preparation of the Preliminary Report by their own Engineers. This refers to Jaipur, Ulwar, Bharatpur, Dholpur, Jodhpur, Kotah, Jhallawar and Meywar.

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4. For the other 13 States, I was placed on special duty in July 1901, to visit any which intimated their desire for assistance in the investigation, to explain the various points on which information was required, systematise the same, examine as far as time permitted the localities where Protective Irrigation Works were proposed, and collect and report all available information regarding them, and assist generally in the preparation of the Reports.

5. The following six States have been assisted in this way:—

Sirohi, Shahpura, Bundi, Dungarpur, Partabgarh and Kishengarh.

6. In *Tonk*, Mr. Wakefield, who is an Engineer by profession, and now Superintendent of Land Revenue in that State, prepared the Report, but they have asked for Government assistance in the cold weather, in working out the investigation.

7. Of the remaining five States—

(*a*) *Bikanir* has asked for me to pay an inspecting visit in the cold weather to report on their proposals.

(*b*) *Jaisalmer* is a Desert Tract and it is not considered worth while to visit it.

(*c*) *Karauli, Banswara* and *Kushalgarh* do not wish to be included in the investigation.

8. In addition to the Native States, for the British District of Ajmer-Merwara, the Executive Engineer, Ajmer Provincial Division, has prepared the returns called for, and he and the Executive Engineer, Mount Abu Division, have, since the commencement of the rains, taken gauge readings of the principal rivers, situated within convenient distances of the roads within their charge, or which pass under the Railway bridges. Statements have been prepared, with plans, showing, (*a*) the catchment areas of these rivers at point of observation; (*b*) a comparison of the rainfall on same during the late monsoon season;—a year of deficient rainfall—as compared with the normal, and (*c*) of their discharge, this year, as compared with the calculated normal discharge.

9. This note will, therefore, deal with the six States, noted in paragraph 5 above, which I have assisted, in the preparation of their reports and preliminary investigation, and for which preliminary surveys and estimates for proposed works have been prepared under my directions.

10. In the short time available it was only possible, after inspecting the various sites proposed, to take:—

(*a*) A longitudinal section of the line of proposed dam.

(*b*) A flying contour at proposed weir level.

(*c*) Plan of the catchment area taken from the 1 mile to 1 inch Topographical Survey maps.

From these—assuming that 20 per cent. of average rainfall was available for storage on hilly catchments, 10 per cent. on fairly level ground with ordinary or black soil, and 5 per cent. on a catchment with a sandy light soil,—the height of the dam required was fixed; the area of land that could be irrigated, allowing 100,000 cubic feet per acre, calculated; and an approximate estimate of cost prepared, from the type section proposed for the dam.

11. The following is a list of the projects in each of these States for which such information, as it was possible to collect on these lines, has been obtained, and which are considered worth further investigation:—

Sirohi State.

(1) Proposed tank at Sirohi.
(2) „ „ Rohera.
(3) „ „ Rybor.
(4) „ „ Danta.
(5) „ „ Bilangri.
(6) „ „ Poidra.
(7) „ „ Girwar.

Shahpura State.

12.

(1) Proposed tank at Dikola.
(2) Thandal River Project.
(3) Mansi River Project.

Bundi State.

(1) Proposed Lake at Katkar.
(2) Chambal Canal River Project.
(3) Proposed tank at Barda.
(4) „ „ Burdika Gotra.
(5) „ „ Pai and Bulapur.
(6) Improvements to the ducts of Hindoli and Dugari Tanks.

Dungarpur State.

(1) Proposed tank at Thana.
(2) „ „ Dolwar.
(3) „ „ Obri.
(4) Nine existing tanks which are in disuse and require repairs.

Kishengark State.

(1) Proposed Tank at Arnia
(2) „ „ Singla.
(3) „ „ Maupura.
(4) „ „ Basra.
(5) Feeder channel from the Natuti Nallah to the Nawa Tank.

For these, preliminary plans and estimates are submitted, together with maps of the States, showing the sites, catchment areas, and land commanded by each; and all information at present available tabulated in the Forms attached.

13 Taking the States in detail—

(A) *Sirohi* (*a*)—The Sirohi tank was started as a famine work, and no plans or estimates had been prepared in detail. As the report of the estimate, now submitted, shows the work will be very expensive and of no profit, except as increasing the water-supply of the Sirohi town. The work was stopped this rains, as I suggested to His Highness the Maharao, the advisability of ascertaining exactly what the project would cost to complete, and if it was financially a successful one. The Maharao is anxious to carry on the work, and so much has already been done*, it should be completed, but the Baldah Nallah diversion scheme, which is part of the project, has still to be surveyed and estimated.

*(a) Value of work done at estimated rates Rs. 14,622.
(b) Estimated cost of completing work exclusive of Baldah Nallah Diversion Rs. 56,231.

(*b*) The Rohera Tank was also started in the Famine without any plans or estimates and there is practically nothing to show for the expenditure incurred except some metal which was broken up for concrete. Excavation for foundations of the core wall was carried out, but no rock was found for a great depth, and these have now all fallen in, and filled up again, so the work will have to be started afresh. This is an excellent site for a large tank, and there is plenty of land below to be irrigated. The Darbar is anxious to start the work, directly they can arrange for funds, and detailed plans and estimates are now required to be worked up.

(*c*) All the other projects proposed are recommended for further investigation; as though, in years of extreme drought they may fail, in normal years they will allow a large area of land at present lying waste to come under cultivation, they will raise the level of the sub-soil water and supply of the wells in the neighbourhood, and all would be excellent relief works.

(B) *Shahpura* (*a*).—It will be seen from the map of the State that Shahpura is admirably situated for irrigation with the Khari Nallah on its north border, and three large Nallahs intersecting the State and running from west to east, and the country having a natural fall in the same direction.

These three Nallahs—

(*a*) The Mansi River,

(*b*) the Thandal Nallah, and

(*c*) the Dikola Nallah,

have large catchment areas, mostly in the Udaipur State and the water they discharge all runs to waste at present. By damming these, as proposed, not far within the west limit of the Shahpura State, and forming large storage reservoirs, it will be possible to utilise the water in irrigating a large area of good culturable land, at present lying

waste, and be of real value to the State, both protective and financially.

(*b*) The Shahpura Durbar also have a proposal for a canal from the Khari River, but as Ajmer, Kishengarh and Meywar have similar proposals, nothing can be done till some mutual agreement is effected, and this, I fear, will not be an easy matter. As far back as 1883, the late Mr. Saunders, the then Commissioner of Ajmer, started the project of constructing a weir across the Khari river, from which a canal would be taken to fill the tanks in the south-east portion of the Ajmer district. The site proposed for the weir, the only one considered possible, was near the village of Garwar in Meywar territory, and the Meywar Durbar were asked if they would raise any objection, or would join in the scheme. At that time the Meywar Durbar were not disposed to move in the matter, but later, in 1884, they consented to the preliminary survey being taken by Ajmer. In 1885 the Superintending Engineer, Rajputana and Central India, with the Executive Engineer, Ajmer Provincial Division, met Mr. Monckton, then State Engineer in Meywar, at the site proposed, and the latter objected to the scheme, on the grounds that— Khari River project.

(*a*) Certain land in Meywar would become water-logged.

(*b*) The construction of a weir on rock, would stop flow of sub-soil water and affect spring level of wells in Meywar villages below.

(*c*) Meywar would gain nothing by the construction of the dam.

After that, nothing further seems to have been done by Ajmer, but I notice that in the papers now submitted by Meywar, a project for a canal from the Khari River, at the site in question is noted as worth further investigation, as it was partly worked out by Mr. Monckton. As an instance of how jealous the States are of their respective rights, and of the difficulties that are likely to arise in working out projects close to the boundaries of any two States, it may be stated, that in taking the preliminary surveys for the Mansi River project for the Shahpura State the other day, the contour line proposed for weir level, passed into Meywar territory, and some survey pegs were fixed in that State. This was reported at once by the Meywar people, and the Political Agent at Deoli, who is in political charge of Shahpura, was asked for an explanation from that State, and for the work to be stopped.

(*C*) *Bundi*—

(*a*) The Katkar Lake, if constructed, should be of the greatest protective value to the State besides being a profitable work. The Durbar are anxious to carry it out, if funds can be arranged, but the surveys and plans and estimates must first be worked out carefully in detail.

(*b*) The Chambal Canal project requires further investigation. The fall of the river from Kotah to Gumach, a distance of 6 miles is only 3 feet and we cannot raise the water level at Kotah more than 3 feet; the head works will have to be lower down the river where there is a greater fall, but as the fall of the country along the line of the canal is very gradual, we cannot go very far below Gumach or the canal cutting would never reach the surface level. The water will have to be stored above Kotah City, where it runs between the two States, as each have equal rights in the water, and let down to the Head Works, and it may be possible to start the canal itself above the Kotah City.

At present the project does not look very promising, but is certainly worth further investigation, as should it be feasible, and an arrangement be made with Kotah to join in the work it would be of the greatest protective value to both States.

(*c*) The other three tank projects are all reported on favourably by local experts, and require prospecting and working out.

(*D*) *Dungarpur.*—(*a*) As this is a difficult country to travel about in during the rains, I was only able to personally inspect the site for the proposed tank at *Thana* and this should undoubtedly prove a protective and profitable work.

(*b*) *and* (*c*) For Dolwar and Obri, I am dependent on the Surveys made by the sub-overseer I sent, and his description. The Dolwar Tank would, I understand, be a valuable work for one of the Bhil—Palsit was the Bhils who suffered so terribly in this State during the late famine. If Obri turns out, as expected, it should be of great protective value. *Mr. Manners-Smith.* 23 Nov. 01.

(*d*) The repairs to the nine existing tanks, which are lying breached, should also be carried out.

(*e*) *Partabgarh.*—(*a*) This State is, like the Malwa country, black soil, good grass land, better rainfall than the rest of Rajputana, and water close to the surface, so that it requires little except increasing the number of wells to protect it against famine. I inspected a site near Dhotia on the Airee River, where a good tank would be formed; there is a lot of land stretching right away to Sohajpur which could be irrigated from the tank, and this in the Bhil portion of the State. Should a famine ever occur again, the Bhils could be better employed on constructing this than anything else, so it is worth further investigation, and plans and estimates might be prepared with this object.

(*b*) The same applies to a site at Phulda.

(*F*) *Kishengarh.*—This State is fully alive to the advantages of irrigation, and has done a great deal in this direction, very few sites being now left. It will be seen that four of the projects now proposed are in the catchment of Sambhar, and under the late orders of the Government of India, cannot at present be considered, though the Manpura project is an excellent one.

14. *Rupnagar Valley Drainage Area.*—This question of the flow of water into the Sambhar Lake, will show the difficulties of extending Irrigation in Ajmer and Kishengarh. It arose at the time of the construction of the Oontra Tank in the Ajmer District in 1899, which was being carried out as a Famine Relief Work. The Salt Department complained that as this was in the catchment of the Sambhar Lake, the construction of the tank would interfere with the flow into the lake, and the Government of India finally decided that the work was to be stopped. In April 1901, the Commissioner, Northern India Salt Revenue, wrote to the Government of India describing the various sources of supply of the Sambhar Lake, stating how certain tanks in the Rupnagar Valley Catchment, interfered with that supply; and thought that in addition to affirming generally the principle that the lake supply must not be further intercepted or impeded, the Government should take some action to free the Rupnagar stream, from some of its existing obstructions. He then suggested that the weir across the Kair Stream from which the feeder to the Ararka Tank in Ajmer Territory starts, should be removed; and the same with the weir from which the supply to the Kuchil Tank in Kishengarh Territory passes down the feeder; as well as the removal of two smaller embankments at Rupnagar. The Government of India (letter No. 3776 S. R. Finance and Commerce, dated 13th July 1901) directed—

(*a*) that observations of the flow in the Rupnagar stream be taken during the present monsoon;

(*b*) that arrangements be made for the maintenance of a continuous record of observation which will indicate more fully the extent to which the supply of water to the lake is being affected by the obstacles referred to by the Commissioner, Northern India Salt Revenue.

(*c*) An opinion on the proposals of the Commissioner for the removal of the obstacles noted above.

The Government of India also notified that it was most inadvisable considering the precariousness of the supply in the lake that any new reservoirs should be constructed in the catchment area; and that the Commissioner, Northern India Salt Revenue, should be consulted before any existing works were enlarged, strengthened or improved.

15. The result of the observations of rainfall and river discharges in the Rupnagar Valley this year are * attached for information, and arrangements will be made for a continuous record of observations in the future, and definite conclusions may be arrived at from which it may be possible for Ajmer and Kishengarh to

* Statement A.

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reasonably ask that the question may be re-considered once more. The Sambhar Lake has suffered like all the tanks in its catchment from a series of years of deficient rainfall and the interests of the Salt Department seem to me sufficiently safe-guarded by the orders of the Government of India without interfering with tanks which were in existence long before the lake* was taken over by the Government of India for working purposes.

*The Sambhar Lake was taken over in 1870.
Ararka was constructed in 1813.
Kactal about 1860.

The investigation of the Rupnagar Valley Rainfall and River Discharge, was placed in my hands and a copy of my report to the Superintending Engineer, Rajputana and Central India, is attached.

16. It will be seen that in this preliminary investigation each State has been treated as a separate unit, and no projects (the Chambal Canal Project excepted) has been considered that would affect several jointly. This was all that was possible, owing to the scattered position of the States I had to visit. What will strike any one who visits these States, is that no attempt has yet been made by them to attack the large rivers and streams in their territories. A large number of tanks exist in each, but these, with very few exceptions, are not irrigation works; they have small catchment areas of surface drainage and nothing more. This is no doubt due in a great measure to their having had no one to advise them professionally, or funds available for these larger projects; but it is only by attempting to store every drop of water that now runs to waste along these large streams, with large catchment areas, that protection will be afforded, and in the projects now submitted, these have been investigated as far as possible.

17. If any good is to come of the works so far carried out, I think detailed plans and estimates should now be worked up, chargeable to Head 35—Famine Protective Works, and the States would then have at any rate a definite Famine Programme to work on, and will be able to employ their labour, when necessity arises, on works of permanent utility to the State and of a protective nature. Without Government aid and supervision the States I have visited can certainly do nothing of any value in irrigation, and the whole question will be allowed to drop.

18. The Resident, Meywar, in forwarding the Preliminary Report of that State, suggests with regard to the new works proposed, that the Durbar be asked if they would agree to a competent Engineer being deputed to Meywar to examine and prepare the estimates and plans required, and considers that these works,† especially the project for damming the Banas River at the Kotar gorge, would be a most useful protective work.

†(a) Khari Project, for bunding Khari River near Barl Station, R. M. Railway.
(b) Bunding the Ganeti River near Chittore.
(c) Bunding the Baraich River above Akola.
(d) Bunding the Banas River at Kotar.

19. These works, if found feasible, would no doubt prove of great value to Meywar; but I would recommend, if the Meywar Durbar would give their sanction, the advisability of a reconnaissance being made of the Banas and other rivers throughout the Meywar territory. It is in Meywar that the head works of any large project affecting other States, as well as Meywar itself, will be found. From an inspection of the map of Meywar, it will be seen that the Beloch and Kotari Rivers flow into the Banas near the towns of Bijod and Nandrai, respectively. With these tributaries the Banas has a catchment area at this point of about 8,000 square miles, and about 6 miles below Nandrai, the river flows for 3 miles through a gorge in the hills. This would appear to be a most suitable place for forming a large storage lake, from which a canal could be taken through Meywar and Ajmer, till the site of the head works of Colonel Jacob's Banas Irrigation Project, near the village of Khegri, was reached; from which point that project for a canal, through a portion of the Jaipur, Tonk and Bundi States could be carried on, as a continuation; with modifications as found necessary to suit the new conditions.

20. Colonel Jacob's project provides‡ for utilising a portion of the flood water of the Banas by building a weir across the river near the village of Khegri, which it is estimated would provide 81 m. c. ft. of water out of the amount impounded, as available for irrigation; irrespective of the water continually flowing in the river. To prevent the river in flood overspreading the country, earthen dams, 1 mile in length on the south side and 3 miles in length on the north side, are provided for, as there was no natural site for a large storage reservoir, and without this Colonel Jacob is of opinion that this project would not be a really good one.

‡ See report on the Banas Irrigation Project, Jaipur State.

21. For any canal project from the rivers in Rajputana, which are dependent on the rainfall, in addition to employing the flood water, a storage reservoir appears absolutely necessary if the *rabi* crop is to be irrigated; as the records of the river discharges of the Banas and Chambal show that not more than 75 c.ft. and 300 c.ft. per second, respectively, can be expected after the end of January. The project I have suggested, as worth investigation, would, it is thought, probably secure a good site for such a reservoir as well as including Meywar and Ajmer in the benefits derived.

22. The following would be the probable length of the canal and areas commanded in each State:—

	Length of Canal.	Areas commanded.	
	Miles.	Sq. miles.	
Meywar	20	100	
Ajmer	11	30	
Jaipur	26	50	Taken from Colonel Jacob's report.
Tonk	19	163	
Bundi	4	27	
	80	370	

§ Proposed Banas Canal Project.

The accompanying tracing § illustrates what is suggested.

23. As this project will benefit several States the investigation will only be possible, if it is carried out by Government; it will be time enough later, if it turns out feasible and promising to settle how the funds are to be provided, if the States concerned agree to the work being taken up.

24. I estimate that with an Assistant Engineer (for the Banas Canal Project Investigation) and 12 to 15 surveyors under my orders, the surveys and complete plans and estimates for the projects I have proposed in each of the States mentioned including the work in Tonk, should be completed during the present official year. The cost of the investigation chargeable to 35—Famine, has been about Rs 8,000 to date, and it is estimated that Rs. 14,000 more will be required to complete the investigation in the manner proposed. If sanctioned, the survey work would be taken up at once, and when completed copies of the estimates and plans would be submitted to the Political Agents and Durbars concerned, and the works would be ready for execution whenever required; or could be kept in reserve and included in the Famine Programme of the States.

25. With regard to *Tonk* (see paragraph 6 above) Mr. Wakefield has submitted estimates, amounting to Rs. 12,895, for taking contour levels of likely commanded areas and streams in the different parganahs.

This, no doubt, would be useful, but for the present investigation where every project has to be treated separately, it would seem sufficient to inspect any projects that are suggested by local experts as possible, and if they appear promising and feasible, have surveys made, and plans and estimates prepared as proposed for the other States who have asked for assistance. Five surveyors, one for each parganah during the present cold weather, should be able to carry out a good portion of what is required, and these have been allowed for in my estimate.

26. With reference to *Karauli*, although the State is *not* included in the present investigation, it may be noted that Mr. C. E. Housden, Executive Engineer, was deputed in 1885-86 to the State to investigate for irrigation works. He made a thorough reconnaissance and submitted a very complete report, and a statement* is attached giving the result of his work. It will be seen that 97 projects were investigated and proposed and sketch plans and approximate estimates of all prepared; and for some of the more important ones, detailed plans and estimates. The largest project was estimated to cost Rs. 4,80,000, and the total of the rest amounted to about 8½ lakhs. The Gotra Tank Project (No. 38 in statement) and Nindar Tank Project (No. 65 in statement) were inspected by Colonel Gordon Cuming, R.E., then Superintending Engineer, Rajputana, who wrote most favourably of them and of the prospects of irrigation in the State, and of the benefits which would arise from gradually carrying out Mr. Housden's proposals, but owing to the then financial embarrassment of the State, nothing was done, and since that time the question seems to have been dropped.

* Statement B.

1. Q. (*The President.*)—You are Superintending Engineer on special duty to assist the States in preparing information for us?—Yes.

2. Q. You have been on special duty since last July?—Yes.

3. Q. Before that had you any experience of these States?—I have served all my service (22 years) in Rajputana.

4. Q. You know all the States pretty well?—Yes; I have, during my service, held appointments in Kotah, Jhallawar, Udepur, Jodhpur and Alwar.

5. Q. In the present case you have confined your service to the States which have not got an Engineer of their own?—Yes; these States were asked whether they wished for my assistance in the preparation of their reports, and those which asked for my assistance, I visited.

6. Q. You have assisted six States?—Yes.

7. Q. Mr. Wakefield has taken Tonk. You have been invited to pay a visit to Bikanir?—Bikanir asked me to come in the cold weather to see if it is feasible to construct certain tanks.

8. Q. I suppose you will manage to get there some time?—Yes.

9. Q. You don't show Karauli?—Karauli replied that at present they did not wish to be included. Some very interesting reports were prepared about irrigation there by Mr. Housden in 1885.

10. Q. Naturally your time has been very short and you have not been able to do more than cursory surveys?—Yes; the States are all scattered and many are not connected to the rail; one has to travel long distances.

11. Q. As regards the general question I suppose our object must be as far as possible to ensure that no water that falls from the skies shall get wasted?—That is all that can be done for Rajputana. It is Colonel Jacob's motto, and it should be our endeavour to work up to it.

12. Q. In dealing with the tanks have you taken them up systematically?—Time was so limited that I could only visit the head-quarters of the States and see the Maharaja and his Dewan and get their ideas. In all these States there are certain local experts who are interested in tank irrigation, and they of course know the district pretty well and put me on to sites; they suggested some sites and I suggested others which appeared feasible from the map.

13. Q. Now assuming that you had sufficient time and that the work could be gone on with till finished, don't you think it would be better to take up each catchment separately and work out the tanks first as a part of a system?—Yes.

14. Q. On what principle do you fix the height of a dam?—We always keep the crest of the waste weir not less than 4 feet below the top of the dam. We take our catchment area, rainfall and percentage available for storage and fix the height of the weir to give the necessary capacity and from this the height of Dam.

15. Q.—Supposing there was only one tank in the series, might you make the bund high enough to hold all the water and have no waste weir?—We have never done that here.

16. Q.—Is there any reason why it should not be done?—No, if it were not too expensive.

(*The President*).—We want to save every drop of water and it seems to me that to carry out Colonel Jacob's idea our purpose ought to be to make a chain of tanks so that there should be no wastage of water.

17. Q. (*Mr. Higham*).—What do you allow for storage?—In Ajmer the maximum amount we allow is 3 inches as available for storage out of 22 inches of rainfall, but on a good many tanks we don't get more than 1½ inches.

18. Q. In Jaipur the total storage capacity of the tank seems to be four times as much as the quantity required for the irrigated area?—Yes, Colonel Jacob has very short weirs and very high bunds; that is the right thing to do if possible.

19. Q. (*The President*).—Assuming you have the site, is that the guiding principle?—Yes, I say you ought to catch every drop of water where it is possible.

20. Q. I suppose in most cases it would be right to pass on water to allow a certain amount to go from the higher to the lower catchment basin?—In these parts I would make big tanks on the higher catchment where the run off is largest and quickest.

21. Q. Do you think that to adopt the principle Colonel Jacob has taken up of having high bunds would mean remodelling a great number of tanks?—I think very little can be done to the tanks in Ajmer and Merwara. They are in a series of chains and hardly ever fill entirely. *Mr. Manners-Smith.*

22. Q. But practically you are carrying out what Colonel Jacob was doing?—Yes, that is the object in Ajmer and Merwara. In the Native States that I have visited there are practically no irrigation tanks at all: they simply take the surface water. 23 Nov. 01.

23. Q. There has been no scientific treatment in the nature of tanks?—Not in the States that I have visited. There are two large old tanks in Bundi—none in Shahpura or Sirohi and plenty of sites.

24. Q. Is it probable that if you were to deal with the tanks in the manner we are now discussing a great deal more water might be stored?—Yes; the amount of water lost is enormous; they have never tackled any large stream or river.

25. Q. You have mentioned towards the end of your report what you require in the way of assistance?—That was to finish the projects now proposed.

26. Q. Do you see your way to getting the necessary surveyors? Do you think the men will be forthcoming?—That is in train; I am arranging for six men to go on with; besides we can get boys who have just passed out from Roorki.

27. Q. Do you not think it would be advisable to work on the lines we have been discussing?—Yes. Far better.

28. Q. It means more work?—You would want a bigger establishment. I was not sure how far Government would go on assisting the Native States.

29. Q. Do you think you could form any estimate of the time that you would take to survey Rajputana in this way, treating it according to its natural features and not according to its artificial or political features?—I could not say exactly.

30. Q. Will you think it over and let us know?—Yes. I am quite sure of this that unless *Government* assist by supervison and financially nothing will be done, though the States are all anxious to have definite plans worked out for them to carry out so as to avoid a repetition of what occurred last famine.

31. Q. As regards your proposals you begin with a long list for Sirohi?—(Witness described from the map and explained his proposals for Sirohi, then passing on to Bundi for a tank at Khatkar estimated to cost Rs. 2,75,000 and to store 3,000 millions cubit feet, and for a canal from the Chambal to cost 9 lakhs to irrigate in Bundi and Kotah. As regards Partabgarh, he said that State only wanted wells; the water was close to the surface and wells could be dug quite cheaply, last year was the first famine for 100 years; the Bhils suffered very severely; the Khamdar had asked witness to express his regret at not being able to present himself before the Commission owing to the trouble the Bhils were giving in the present drought. There is any amount of water in the sub-soil and all the people have to do is to dig a well or rather a big hole costing one or two hundred rupees. The water is at a depth of about 20 feet. The death-rate in the famine was purely a *Bhil* death-rate—the Bhils are not where the wells are. It is difficult to understand why there should have been a famine in the well tract. The Khamdar said many people had come in from Marwar. With respect to Karauli Mr. Housden's report and plans drawn up in 1885, suggesting certain projects, were produced. Witness also explained from the map his proposals regarding the other States he had visited.

32. Q. (*Mr. Higham*).—How do you get the rainfall of the different States. Have they recording stations?—In Dungarpur there are no proper records, but in other States there are.

33. Q. Are they kept up properly?—I am not in a position to say whether they are or are not. I suppose the Political Agents inspect them. (Mr. White explained that they are carefully looked after by the Agency Surgeons.)

34. Q. With regard to this statement of river discharges you have not any records of the discharges?—No. We fix gauges at certain places.

35. Q. You had a man recording them?—Yes; at every place.

36. Q. How were the discharges worked out?—From the velocity and area of the cross sections.

37. Q. Who took the discharges; a native?—Yes; he kept a record of duration and depth of flood, and the surface velocity.

Mr. Manners-Smith.

23 Nov. 01.

38. *Q.* Do you trust them to take discharges?—We had no one else.

39. *Q.* You have to keep a man at each place, what does it cost you?—Rs. 7 a month each man.

40. *Q.* They have to take the discharges—You have some one to take the velocity?—Yes; these men took the velocities.

41. *Q.* Have the men watches?—Yes.

42. *Q.* Will there be any difficulty in maintaining the record?—Not if Government pays for it.

43. *Q.* When the Banas is in flood, I suppose it has a very large discharge?—Yes.

44. *Q.* Have you any observations?—No. Observations were taken some years ago under Colonel Jacob's directions which you will find in the printed copy of the Jaipur Banas Canal Project.

45. *Q.* Your men could not take the discharges?—No, they could not have taken the Banas discharges. If it was *decided to record discharges of certain big rivers*, arrangements could be made to have proper discharges taken.

46. *Q.* You would have to make observations in different territories, would there be any objection to your putting up gauges?—No, there would be no difficulty.

47. *Q.* (*Mr. Ibbetson*).—These small States are scattered over the whole of Rajputana?—Yes.

48. *Q.* You have been able to get a very good idea of Rajputana as a whole?—Yes.

49. *Q.* With reference to the suggestion that Rajputana *should be treated without reference to its political divisions* could you always neglect political objections; for instance, would you not have to consider the rights of the several States to the water?—Certainly.

50. *Q.* I suppose it is not impossible that some project you might have would interfere with a big scheme of a State which had an Engineer of its own?—Yes, this might occur. To make the thing successful, it would be necessary when an investigation affecting 2 or more States was on hand for the Engineers to be instructed to note on the projects which are proposed and communicate with each other so that they should not act in opposition to each other.

51. *Q.* Would it not be better to have a chief authority to co-ordinate the whole?—Yes, I think there *ought to be* one person in authority. I think you would also have to have a *panchayet*—say some officials of the States to consider the rights of each State, and their proposals would be submitted to the Chief Authority for final settlement.

52. *Q.* So far your work has been confined to collecting information for us, and to working up proposals for those projects which, from your enquiries and a rough reconnaissance of the country, you considered to be sufficiently promising?—Yes, I had no idea that the investigation would be extended beyond that; I had to collect such information as I could in the time, but I agree that the other or systematic investigation now proposed is the right thing to do.

53. *Q.* Would it not be well to complete your present projects first; they would then be available in case of emergency?—I think so; certainly no harm would come from that.

54. *Q.* You think the works you propose will pay?—I have put down the profits on each. The lowest profit is in Sirohi, 4 per cent.

55. *Q.* How did you get at these figures?—I got the quantity of water that is stored in the tank and I allowed one hundred thousand cubic feet per acre, from this I calculated the area that could be irrigated, and the probable return per annum on this area. The ordinary rate I put down is Rs. 4 an acre, but in those States which have no revenue settlement I put down Rs. 2 or Rs. 3 per acre. I have always attempted to under-estimate the revenue and over-estimate the capital cost of the work. I have simply taken the quantity of water in the tank and estimated the area that it could irrigate.

56. *Q.* (*Mr. Higham*).—What are the principal projects you contemplate?—For the Sirohi State it is proposed to construct tanks at the following seven sites:—1 Sirohi, 2 Rohera, 3 Rarbor, 4 Dauta, 5 Bilangri, 6 Poidra, 7 Girwar. In Shahpura there are projects for utilizing the waters of the Thandal and Mansi rivers and for constructing a tank at Dhikola. In Bundi there are the Chambal Canal project, the Khotkar Lake project, and proposed tanks at Birda, Bundi-ka-Gotra and Pai Balapura. For Dungarpur we propose tanks at Thana, Dolwar and Obri. For Kishengarh a tank at Arnia; and for Meywar there is the Banas Canal project.

THIRTEENTH DAY.

Rajkot, 29th November 1901.

WITNESS No. 24.—MR. H. S. DAVIES, Agency Engineer, Kathiawar.

Mr. Davies.

29 Nov. 01.

REPLIES TO PRINTED QUESTIONS.

Tanks.

23. The tanks under the Kathiawar Agency are supplied from streams and rivers. The catchments of these tanks vary from 3 to 50 sq. miles. The supply is entirely dependent upon the rainfall. In a year of scanty rainfall the two larger tanks receive (from the Lalpuri and Bhadar rivers respectively) 2 cubic feet per second during the cold season. The water is distributed to the land by open canals or dhorias. *In a year of ample rainfall* the supply *from large tanks* would be maintained:—

From July to October—For rice occasionally.
„ October to February—For wheat.
„ February to July—For chasatia and lucern.

From small tanks—

From July to October—For rice occasionally.
„ October to February—For wheat.

In a year of scanty rainfall, from large tanks—

From July to October—For rice occasionally.
„ October to February—For wheat.

From small tanks—

From July to October—For saving monsoon crop.

In a year of drought, from large tanks—

From July to October—For saving monsoon crop.

From small tanks—Nil.

The area of wheat ordinarily irrigated from a tank is at $\frac{1}{40,000}$ of the total storage capacity of the tank.

24. The increase of value of the produce of land is:—

(1) By securing 1½ harvests (half of the whole area is irrigated and half kept for monsoon crop; *when the monsoon crop is harvested one-fourth* of this area is added to the other half).

(2) The chief increase of value is due to the substitution of more for less valuable crops.

(3) *In years of ample rainfall.*—There is no advantage to monsoon crops but rice and all perennial crops benefit by irrigation during the rains.

In years of scanty rainfall.—The larger lakes would save the monsoon crops and irrigate a certain quantity of wheat but the smaller tanks would not do more than save the rain crops.

In years of drought.—The larger tanks might possibly save what the cultivators were able to sow, but from smaller tanks no assistance may be expected.

25. The value of irrigation is diminished by two-thirds by the too late commencement and too early cessation of the supply. For wheat Rs. 6 per acre for full watering is charged and for part watering only Rs. 3.

26. The irrigation from wells on lands irrigated from tanks, takes place only when the tank water fails.

27. The increase in the total annual value of the produce per acre in ordinary years, for the ordinary monsoon crops and wheat, is about Rs. 17 per acre. See Appendix D.

(2) *In a year of drought,*—The monsoon crop might be saved at an expense of Rs. 4 per acre for water and labour. A net increase in the value of produce of Rs. 2-4-0 per acre.

28. The average annual rate per acre paid on account of irrigation—

(1) By the cultivator to the owner of the tank is at the schedule as per Appendix H.

(2) By the cultivator to the owner of the tank at an average enhanced rental of Rs. 8 per acre.

On the Lalpuri left bank the water is paid for upon the total area of the holding at an average rate of Rs. 8 per annum. On the right bank of the Lalpuri and elsewhere in the Province, the rate is paid upon the area actually irrigated at the schedule as per Appendix H.

29. The water is brought to the fields by the State.

30. The maintenance is provided for by the landlord. *The approximate cost per acre irrigated may be taken at* Rs. 1-8-0, *vide* Appendix D. The system works well and no legislation is required.

31. No tanks have been built by private persons, other than the Chiefs of Kathiawar.

32. No remarks to offer.

33. It is yet too early to say what silting of tanks will take place. Silting is going on we know, but no data have been collected. The ultimate silting up of the tanks in this province can only be at a fairly distant date however, as the catchment areas are, generally speaking, bare morum hills from which the water does not bring down much silt although it becomes greatly discoloured.

Wells.

34. (1) Average depth of wells is 25 to 30 ft.

(2) The supply is from springs and percolation. If made in a year of drought the well does not fail. In some places when the well is drawn upon for a long time the water becomes too saline for use, but generally speaking this is not the case. In years of drought about half the usual supply can be reckoned upon.

(3) Average cost of construction, Rs. 125.

(4) Permanent.

(5) By môt.

(6) Average area commanded by a well of 1 môt capacity, 8 acres. Some wells have as many as 4 môts and would therefore command 32 acres of land.

(7) Average area irrigated in any one year—

4 acres wheat, or 2 acres rice, or 2 acres sugarcane.

35 (1) Three harvests in two years are reaped on whole area.

(2) Increase of value is due to more valuable crops.

(3) *In year of ample rainfall*—no increase.

" " *scanty rainfall*—rain crop would be saved.

" " *drought*—no sowing would take place.

36 (1) The increase in the total value of the produce due to irrigation is approximately Rs. 9-8 per acre.

Value of irrigated crop—

	Rs.
4 acres jowari	25
4 acres wheat	180
	205
Deduct interest on well, Rs. 125 at 8 per cent.	10
Watering for 2 months and other expenses	50
Tax on well	20
	80
Net value of crop	125
Value of rain crop without irrigation—	
8 acres Jowari at Rs. 6-4	50
Difference due to irrigation	75

$\frac{75}{8}$ = Rs. 9-8 *per acre approximately.*

(2) In a year of drought the rain crop would not be sown, but half the usual quantity of wheat would be raised, which is equal to . . Rs. 90

Deduct expenses—

Interest on well	10
Watering for 2 months	25
½ Tax on well	10
	45

$\frac{45}{8}$ = Rs. 5-8 per acre.

37. The average annual rate paid to the landholder by the cultivator on account of irrigation is Rs. 2-8 per acre.

(For a one well Vadi of 8 acres the charge is Rs. 20.)

38. The amount is paid upon the total area attached to the well, *viz.*, 8 acres for each môt.

39. An expert has usually to be called in to select the site for a well in *Rajkot* State. Money for the purpose of sinking a well is advanced by the State at the rate of Rs. 60 for a one môt well and Rs. 25 for each additional môt. The cultivator must pay the annual tax of Rs. 20 on the well or refund the advance.

Boring tools requiring the use of experienced men have not been used. The construction of wells is easy. The lower part of the well requires blasting and as the soil is not of great depth only the upper part of the well requires to be built up with masonry.

Mr. Davies.
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APPENDIX D.

LALPURI TANK.

Average value of produce per acre over irrigated area previous to the making of the tank is Rs. 15,000 or Rs. 8-5-4 per acre $\left(\frac{15,000}{1,800}\right)$.

Average value of produce from irrigation last year Rs. 48,100=Rs. 26-11-7 per acre.

Value of crops grown by irrigation from the tank—

	Acres.	Per acre. Rs. A.	Rs.
Jowar	267	at 6-4	1,670
Bajri	248	at 6-4	1,550
Cotton	83	at 10 0	830
Rice	150	at 40 0	6,000
Vegetable	150	at 25 0	3,750
Til	100	at 12 0	1,200
Wheat	420	at 45 0	18,900
Methi	121	at 28 0	3,388
Gram	82	at 6 0	492
Chhasatia	80	at 6 0	480
Chino	15½	at 9 0	140
Sugarcane	18	at 150 0	2,700
Lucern	100	at 70 0	7,000
TOTAL			48,100

Value of crops grown in the same land before the formation of the tank—

	Acres.	Per acre. Rs, A.	Rs.
Jowari	750	at 6-4	4,689
Bajri	700	at 6-4	4,375
Cotton	50	at 10 0	500
Rice	20	at 40 0	800
Vegetable	10	at 25 0	250
Til	25	at 12 0	300
Wheat	60	at 45 0	2,700
Methi	12	at 28 0	336
Gram	175	at 6 0	1,050
TOTAL			15,000

MAINTENANCE.

Without irrigation	*Nil.*
Supervision	100 Rs, per mensem.
Wages	110 "
TOTAL	210 "

or per year Rs. 2,520.

Therefore $\frac{\text{Rs. } 2,520}{\text{acres } 1,800}$=Rs. 1-6-3 expenditure per acre.

Total net increase of value of produce of irrigated land Rs. 17 per acre.

Mr. Davies.

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APPENDIX H.

Schedule of water rates charged on different crops for water supplied from tanks.

	Per acre. Rs.
Bajri	2
Jowari	2
Cotton	3
Kang	2
Banti	2
Kothal	6
Sisam	2
Wheat	6
Methi	4
Gram	2
Chhasatia	6
Sugarcane	25
Lucern	12
Vegetables	20
Rice	8
Bhusing	8

1. Q. (*The President.*)—Mr. Davies, I understand that you are Engineer of this Agency?—Yes.

2. Q. What is your position in regard to the engineers of different States?—Some States have got their own engineers.

3. Q. Are they under your control in any way?—No.

4. Q. What are your duties exactly?—I am Engineer for the Agent and have to carry out his orders for the managed estates and the different thanas under the Agent.

5. Q. There is a certain portion of Kathiawar under the direct administration of the British Government?—Yes, and there are imperial and provincial works in Rajkot, Wadhwan, Jetalsar and Songad the head-quarters of the Provincial Officers.

6. Q. (*Mr. Ibbetson.*)—In British territory?—Under British jurisdiction.

7. Q. (*The President.*)—Is Rajkot a British territory?—No, it is different from the Rajkot Civil Station.

8. Q. It is considered to be under your control?—Yes.

9. Q. How long have you been in Kathiawar?—Over ten years, but only two months in this position.

10. Q. Were you here in the famine?—No, Mr. Mawson was here.

11. Q. (*The President.*)—You have sent in very interesting particulars regarding the State irrigation?—I wish to explain that regarding the tanks which were constructed to provide against famine I have given a separate tabular statement prepared by Mr. Mawson.

12. Q. (*Mr. Ibbetson.*)—The tanks were not under your supervision?—No, Mr. Mawson's.

13. Q. You talk about tanks whereby you make provision for irrigation right through the year? Are there tanks that hold water right through the year?—There are some; one the Lalpuri and the other at Jasdan.

14. Q. That is the one we are going to see?—Yes.

15. Q. (*Mr. Ibbetson.*)—Is it irrigating now?—Yes. The Lalpuri tank would irrigate throughout the year but it has to keep 2 years' supply of drinking water for the City.

16. Q. (*The President.*)—At the beginning of Appendix D, you say that the average value of the produce per acre on unirrigated land is Rs. 8-5-4 and on irrigated land Rs. 26-11-7?—Yes.

17. Q. That was at last year's prices?—No, sir, it is for this year; prices are still low.

18. Q. (*Mr. Muir-Mackenzie.*)—Last year's prices were low?—Yes. The figure in the statement could not be exactly arrived at; it is as near as we can get it.

19. Q. (*Mr. Ibbetson.*)—That is the value of the produce in a year of drought?—No; in an ordinary year.

20. Q. (*The President.*)—Are relief works going on now?—We are starting them just now. I have given the details of the projects, and have submitted estimates. The works we are taking in hand now are Sudamda Tank for Palia and other Thanas in the Jhalavad Prant. That is the northern part of the district. The only important work is Wangadhra Tank at Dedan which was started; a little work was done on it during the famine. Now we intend to complete it.

21. Q. Are you going to do it immediately?—Yes, I am preparing the plans.

22. Q. Are you doing it on ordinary Public Works lines or special?—On normal Public Works lines. I do not think that people are so needy as to have special work opened.

23. Q. Do you recognize the benefit of tanks in maintaining the water in the wells?—Yes. There is always a certain amount of leakage.

24. Q. The cost of a well is Rs. 125. Is it not a low figure?—No; we get water very near the surface. In Kathiawar you may take it that the wells are shallow.

25. Q. What is the meaning of *chhasatti* crop?—That is the hot weather *juari* crop; it means 60 days' crop.

26. Q. (*The President.*)—What do you consider the best form of famine relief for Kathiwar?—Tanks are the best form of famine relief. Wells are useful but difficult of supervision when a large body of people has to be provided for.

27. What means do you think are best for protecting Kathiawar against future famines?—Tanks would not store water for more than a year as a rule; and they are expensive to build; the storage of water is therefore expensive. You have also to consider the question of evaporation and percolation if water has to be stored for any length of time. As regards wells, in a year of drought probably the bullocks would be dead and to provide cultivators with new bullocks, seeds, etc., would be more expensive than feeding the people. The question is thus to get food and supplies to the people as quickly and cheaply as possible. This would point to railways or some light feeder lines.

28. Q. You show that the increase in the value of the produce due to irrigation from the Lalpuri tank is Rs 18-6-3 per acre?—It is Rs.17 per acre. I am allowing Rs. 1-6-3 for maintenance that brings it down to 17.

29. Q. (*Mr. Ibbetson.*)—In value?—Yes.

30. Q. Does the State share in this?—Yes, they take a consolidated water rate including land revenue which averages Rs. 8 per acre.

31. Q. (*Mr. Muir-Mackenzie.*)—Do you allow for water rate charges?—Not in this case. I have shown the water rate charges in another statement.

32. Q. (*Mr. Ibbetson.*)—Is that water rate in addition to the land revenue?—Not in this case. It is for the left bank of Lalpuri where the water rate charges are levied on the crop system.

33. Q. Rs. 8 is not the general charge?—No, it is only for a particular area of Rajkot. This water rate for the left bank of the Lalpuri and elsewhere in Rajkot is according to the scale which I have given in Appendix H.

34. Q. They take Rs. 8 as water rate and yet take a share of the produce?—No.

35. Q. That includes everything—land revenue?—Yes.

36. Q. Was there any distress in 1896?—I was then on railways.

37. Q. You say bullocks have to be provided in the year of drought?—I have to point out that these matters are not from personal experience. I have gathered such details from Mr. Gopaldas who will give evidence before you. Please ask him.

38. Q. (*Mr. Muir-Mackenzie.*)—You say in a year of drought tanks are not filled? That applies to all of them?—There are only two tanks on large rivers—the Lalpuri and Bakhalwad. In all tanks the leakage and evaporation is very great and to get the best results for the water stored would be to let it out quickly for the wheat crop which lasts only for two or three months.

39. Q. When must it be let out?—By February.

40. Q. In the case of normal rainfall the majority of these tanks hold water till February?—Yes.

41. Q. Is that enough for the cultivation of wheat?—Yes.

42. Q. (*The President.*)—At the end of February all water would be exhausted?—Yes.

43. Q. (*Mr. Muir-Mackenzie.*)—You have had several bad years since the tanks were made?—No; we had one good year but the tanks were not quite ready. Last year the

tanks were ready, but on account of scanty rainfall they were not filled. Last year they would have irrigated the crops up to the end of February.

44. *Q.* This year?—This year we have scanty rainfall, it is not normal. The monsoon of 1900 was normal; but the monsoon of 1901 is scanty and the water will not last until February.

45. *Q.* (*The President.*)—It would be exhausted in January?—Yes.

46. *Q.* They do not store more than one year's supply?—No. In the year of normal rain the tanks will fill, but by February the smaller tanks will be exhausted. In the larger tanks there is an inflow which would keep up the supply until July.

47. *Q.* (*Mr. Muir-Mackenzie.*)—You cannot tell us anything about wells of your own knowledge?—No; not from my own knowledge. I have gathered certain details from the local authorities.

48. *Q.* These outturns which you give are not checked by experiments?—No. *Mr. Davies.*

49. *Q.* They are estimates of Revenue officers?—Yes. 29 Nov. 01.

50. *Q.* Do you think they can be relied on?—Yes; they may be. In a great many villages they have *bhagwati* system. They take a share of the produce.

51. *Q.* (*Mr. Rajaratna Mdlr.*)—You say that for wells 8 acres are taken as the area irrigable and Rs. 20 are paid for the landlord?—Yes, in Rajkot State.

52. *Q.* Is that assessment paid whether the land is irrigated or not?—Yes.

53. *Q.* Rs. 20 is to be paid whether any portion of the area is irrigated or not?—Yes.

54. *Q.* Is it so in cases where the *rayat* receives an advance or whether he sinks the well himself at his own cost?—He gets an advance from the State.

WITNESS No. 25.—Mr. E. W. PROCTOR SIMS, State Engineer, Bhavnagar.

REPLIES TO PRINTED QUESTIONS.

General.

1. Bhavnagar State. Having been employed in the Bhavnagar State, Public Works Department, for 12 years, and as Famine Commissioner for some time during the last famine.

2. Average rainfall during the last five years:—

June	2 inches	48 cents.
July	8 „	32 „
August	6 „	92 „
September	5 „	99 „

3. (1) Yes, among the cultivators.

(2) No.

(3) Excepting in towns where there is a municipality, there is always an insufficient supply of manure. Irrigation in villages almost entirely depends on the amount of manure that can be obtained in the village. Crops (wheat and juari) are irrigated without manure, but are poor. (Village manure composed of cattle-dung, ashes and village sweepings.)

(4) All the cultivable soil in Bhavnagar territory is suitable for irrigation *if the water used for irrigation could be obtained sweet.*

(5) There are no tank-irrigation works in the State. In ordinary years the wells contain sufficient water.

(6) Yes.

(7) No.

(8) No.

(9) (*a*) Where the land is sweet and water brackish one crop can be obtained, but the land is practically useless for 5 years afterwards, as the rain crops which cultivators almost invariably sow are very poor and only produce a scanty supply of food for cattle. *Mr. Proctor-Sims.* 29 Nov. 01.

(*b*) Tank and river irrigation works could be constructed in various parts of the State if it were not for the rivers, in most cases, running partly through foreign jurisdiction.

(*c*) Scattered holdings are a further obstacle. A cultivator takes up, say, 100 bighas (about three fields), of land and if he does not get the fields adjoining each other, but about a mile apart, it would be impossible for him to irrigate a part of each field and pay personal attention to each of them. Cultivators seem only prepared to irrigate the amount of land to which they can personally give attention. There is a saying among them that "Whatever a hired labourer makes he keeps," and the cultivator gets nothing.

(*d*) Large holdings are also objectionable as some cultivators are satisfied with the produce of the kharif crop and only irrigate about 12 bighas (one well of two kos) of rabi crop.

4. Land irrigated from wells constructed by private capital is exempt from water assessment until the next Revenue Settlement. The existing provisions are sufficiently liberal.

6. No.

Tanks.

There are no irrigation tanks at present in the State, but schemes for constructing them are being prepared.

A list giving roughly the area they would irrigate if constructed, is attached.

Proposed Irrigation Schemes in the Bhavnagar State.

1	2	3	4	5	6	7	8
No.	Where situated.	Nature of soil submerged.	Catchment area.	Acres it will irrigate.	Kind of Dam.	Cost of Dam.	REMARKS.
1	*Ambla Irrigation Scheme.*						
	In Sihor Mahal.	Muram	6¼ sq. miles most of moorum.	1,800 acres	Earthwork	88,000	This work could be constructed as a Famine Relief Work and would give employment to 2,000 people for six months. Some way below the dam site the nallah forms the boundary of an Agency village with Bhavnagar territory, and still further it runs through Gogo territory, objection might possibly be raised by these against its construction.

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Proposed Irrigation Schemes in the Bhavnagar State—concld.

1 No.	2 Where situated.	3 Nature of soil submerged.	4 Catchment area.	5 Acres it will irrigate.	6 Kind of Dam.	7 Cost of Dam.	8 Remarks.
2	*Ramdhari Irrigation Scheme No. 1.*						
	In Sihor Mahal.	Moorum .	6 sq. miles in moorum hills.	2,000 acres	Earthwork .	80,000	This work could be constructed as a Famine Relief Work and would give employment to 2,000 people for six months. The land submerged belongs entirely to Bhavnagar Bhayats and the land irrigated would be theirs also. There would be no profit to the Bhavnagar Darbar in building this, unless the village was taken from the Bhayat and another one given in its place.
3	*Ramdhari Irrigation Scheme No. 2.*						
	In Sihor Mahal.	Moorum .	7½ sq. miles in moorum hills.	2,000 acres	Earthwork .	91,000	Could be utilised as a Famine Relief Work and would give employment to 2,000 people for six months. The land submerged belongs entirely to Bhavnagar Bhayats and some arrangement for settling this question would be necessary.
4	*Sandira Irrigation Scheme.*						
	In Sihor Mahal.	Moorum .	5 sq. miles in moorum hills.	800	Masonry .	...	A temple is situated exactly on what would be an *earthen* dam site. About half a mile further up the East nallah there is a good site but owing to the contracted water-way the dam would be of masonry. Most of the land it would irrigate belongs to Mul-Grasias.
5	*Sihor Irrigation Scheme.*						
	In Sihor Mahal.	Moorum .	13¾ sq. miles	2,400	Masonry .	1,00,000	Owing to a contracted water-way the dam would be of masonry.
6	*Megwadar Irrigation Scheme.*						
	In Sihor Mahal.	Moorum .	10 sq. miles	2,700	Masonry .	75,000	The nallah passes through a narrow gorge and the dam would be of masonry.
	Other possible Irrigation Schemes but which have not been inspected with a view to irrigation tanks. (*The figures given are approximate.*)						
7	*Itia Irrigation Scheme.*						
	Mahuwa .	Moorum hills	19 sq. miles	6,000	...	...	
8	*Bhimrad Irrigation Scheme.*						
	Botad .	...	34 sq. miles	9,000	...	...	
9	*Kobadia Irrigation Scheme.*						
	Mahuwa .	Moorum hills	7½ sq. miles	2,600	...	...	
10	*Balapur Irrigation Scheme.*						
	Port Albert Victor.	Moorum and poor cultivated ground.	20 sq. miles	7,300	...	...	Lower down, this nallah forms the boundary line of the Bhavnagar and Junagad States. The Junagad State would probably object to having a dam thrown across the river.

1. Q. (*The President.*)—You have been twelve years in Bhavnagar?—Yes.

2. Q. You were also in the last famine?—Yes.

3. Q. What measures would you recommend to protect the State against future famine?—From an irrigation point of view, wells only.

4. Q. There is no tank irrigation possible in Bhavnagar?—We have certain difficulties. Rivers some way below sites of dams run through lands not belonging to the State and the owners of these lands object to have the rivers bunded.

5. Q. The objection is not a physical but a political one?—Yes.

6. Q. Supposing that political objection is got over?—We could construct ten or twelve tanks.

7. Q. Has this question been raised as regards coming to terms with other States?—We had a case on the south part of our State, and the question was raised, but the

then Political Agent decided against us. Owners lower down don't like the water being bunded up above them.

8. *Q.* During the time you have been in Bhavnagar there has been no proposal for any co-operative action between the different States?—No. Representations have been made, but nothing has come of it.

9. *Q.* Do you think this probably will not be done; would it be difficult to work it?—I should think so; a great deal of jealousy exists.

10. *Q.* You have a list of tanks, but they are all small?—Yes. They are all small.

11. *Q.* They are only intended for drinking purposes?—None of them could irrigate except a few which were enlarged.

12. *Q.* From the nature of these works they were better adapted for employing famine labour than to be carried out beforehand as protective works?—Yes; small tanks don't afford much protection though the villagers say they do good to wells.

13. *Q.* Since the famine, has there been a great increase in the number of wells?—A great number of wells were dug by the Revenue Department.

14. *Q.* Are these permanent wells?—Some of them are permanent.

15. *Q.* They do not come under your supervision?—No, we had our large works of road-making, etc.; I made a few at first, but the Revenue Department took charge of them and they were charged to Civil agency works.

16. *Q.* What is the size of the Bhavnagar State?—About 3,000 square miles; I am not quite certain.

17. *Q.* Your river flows through other States?—Yes. We have got small villages like islands in our State, that belong to other owners, and they are generally situated on the bank of a river.

18. *Q.* In ordinary years a great deal of water must go to waste?—Yes.

19. *Q.* Do you see any reasonable and practical means of checking that?—Not unless we and the other States agree to co-operate.

20. *Q.* Want of agreement is really the obstruction?—Yes.

21. *Q.* Had you occasion to observe the spring level?—No.

22. *Q (Mr. Rajaratna Mdlr.).*—You say in one case, the construction of a tank was disallowed by the Political Agent?—It was a *kacheha* bund put across the river.

23. *Q.* What is the reason of their objection?—The water lower down flows past villages belonging to other States and they object.

24. *Q.* How would the construction of a dam in Bhavnagar State prejudicially affect others?—It would affect the villages lower down.

25. *Q.* That is a reasonable objection. Are there any cases in which the interests lower down would not be prejudicially affected?—One or two probably.

26. *Q.* You could build small tanks without affecting the interests lower down?—Yes.

27. *Q.* You refer to proposed irrigation schemes?—I proposed these schemes simply in case these objections were removed. We can use the schemes if the objections are removed. *Mr. Proctor-Sims.*

28. *Q.* Otherwise they could not be taken up?—No. 29 Nov. 01.

29. *Q.* In your first schemes you say employment can be provided for 2,000 people for six months?—Yes.

30. *Q.* How is that calculated?—According to your figures you give about Rs. 45 to each man for six months. That is a very liberal allowance?—I put it down at 30 cubic feet per unit; the lift is high.

31. *Q.* You say the wells were constructed by the Revenue Department?—Yes.

32. *Q.* If advances are given, the cultivators could do it themselves?—Yes.

33. *Q.* You mean that the wells can be constructed by the cultivators with the aid of advances?—Yes.

34. *Q.* I suppose these advances are granted and then recovered?—I believe if the State digs wells the cultivator has to pay water assessment; but if the cultivator digs a well himself he has not to pay assessment.

35. *Q.* Advances are granted for the purpose of constructing wells, subject to the condition of its being repayable with interest?—I do not think so.

36. *Q. (Mr. Ibbetson.)*—You were here in 1896?—*Yes.*

37. *Q.* Was there any distress here in that year?—We had a certain amount.

38. *Q.* What was that distress due to; was it due to the general shortness of rain or to the sudden cessation of rain?—It was short rainfall in our State all through.

39. *Q.* Were your tanks full then—village tanks?—I cannot say.

40. *Q.* I mean the irrigating tanks that you speak of as having been enlarged?—Our tanks do not irrigate; they are simply village tanks.

41. *Q.* There is no irrigation by tanks at present?—No.

42. *Q.* You made a certain number of wells which are at present under the Revenue Department?—I started the work; then the Revenue Department took it over from us.

43. *Q.* In selecting a site what method do you adopt to ascertain whether the well will be successful?—We leave it to the cultivators, *i.e.*, we asked the cultivators themselves where they want to dig and I put the men on.

44. *Q.* You did not enquire whether they gave sweet water or salt water?—No.

45. *Q.* You did not make any trial boring?—No; I simply put the men on.

46. *Q.* You say here "irrigation in villages almost entirely depends on the amount of manure that can be obtained." Is that your personal experience?—I was Famine Commissioner for a short time and I made enquiries.

47. *Q.* Can you say that irrigation injures the soil?—I cannot say.

48. *Q (Mr. Muir-Mackenzie.)*—With regard to these difficulties with States lower down can they not be removed?—I fancy the States would be prepared to do something; but some one must go to all the Chiefs and have a meeting.

49. *Q.* Do you think if such a meeting were held this difficulty would be removed?—It might be removed.

50. *Q.* Do you think half the water let down to the State below would compensate it?—I think it might.

Witness No. 26.—Mr. Gopaldas Viharidas Desai, Revenue Commissioner, Bhavnagar State.

Replies to Printed Questions.

General.

1. Bhavnagar State. Having been employed in the Revenue Department for 10 years.

2. *Average rainfall in each month of the year:—*

Month.	In.	Cen.
June	4	48
July	8	32
August	6	92
September	5	99

The figures show an average of the last five years.
A statement of the similar average of the different districts is appended. *Gopal Das Viharidas Desai.* 29 Nov. 01.

3. (1) No.
(2) No.
(3) Yes.
(4) No.
(5) There are no irrigation canals.
(6) Yes.
(7) No.
(8) No.
(9) (*a*) There are some tracts in which the soil is sweet and water brackish and in some the condition is

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reverse; also in some places both soil and water contain salts. In these tracts irrigation results in deterioration to the soil from salt efflorescene. When an irrigated crop is raised in land of the above description, it is required to be kept fallow for two years in order to be suitable for cultivation.

(*b*) There are some rivers whose course can be utilized for irrigation purposes, but the intervention of foreign jurisdiction through which they flow has been an obstacle.

(*c*) Population in most parts of Kathiawar is small in proportion to the cultivable area; the holdings are therefore so large that the rayat has not yet learnt to bestow proper amount of labour and attention on cultivation. A holder will be quite satisfied to possess only one well of two motes' capacity in his holding, and he is too lazy to extend the area under irrigation. Notwithstanding the growing desire on the part of the rayat to have means of irrigation at his command, he will not exert beyond a four or five-acre plot to grow irrigated crops.

4 Land irrigated from wells constructed by private capital is exempted from water assessment for the period of the Revenue Settlement. The existing provisions in this respect are sufficiently liberal.

5. We don't advance loans as a rule for land improvement, but we make free grants instead. In cases of wells constructed by a grant sufficient to cover expenses given by the Darbar, separate water assesment is charged, but in cases of failure of an attempt to obtain water no assessment is levied, nor is the money spent recovered from the occupant. Remission of interest, partial remission of the advance and easy instalments would in my opinion be a sufficient encouragement for the extension of wells.

6 No.

Canals of Intermittent Flow.

12. 1. There are small irrigation channels supplied by temporary dams thrown across river-beds in the districts of Talaja, Mahuwa and Kundla.

In Talaja a *kachcha* dam was thrown across the Navli river near Mouze Fulsar 20 years ago by the cultivators at their own expense. This dam is now in most places consolidated, and every year, after the rainy season, the cultivators repair the gaps by sinking spikes of wood and branches of trees and fill them up with ballast. From both sides of the river the villagers have according to their convenience constructed channels leading to their fields. The initial expenditure was about Rs. 125, and the annually recurring expenditure is Rs. 25. About 50 occupants utilize this channel for irrigation and thus the average cost comes to As. 8 per each.

In a year of good rainfall it is capable of irrigating 120 acres and in a year of scanty rainfall about 40 acres.

This canal as will be seen from above is supplied with water from the flow of the river. In such channels irrigation is supplied by the surface flow and not from any storage of water. From the main channel water is taken to the fields commanding it, by conduits connecting it with the land to be irrigated.

2. The cultivators always arrive at a good understanding regarding their several turns and the time for the supply of water. In case of dispute, which seldom arises, the Patel or Headman of the village settles it amicably and hence Government is not obliged to interfere.

3. (*a*) In a year of ample rainfall the flow is kept up till the end of May; (*b*) but in a year of scanty rainfall the supply is sufficient for irrigation only up to the end of March for a very much less area; (*c*) in a year of drought this channel is not serviceable. In Mahuwa district there are two such channels, *viz.*, from the Malan river near Mouze Umamavadar and the other from the Bhadrodi near Mouze Khatsura. The former which is constructed and maintained by the Darbar at State expense, which is not considerable, has a continuous flow except in a year of drought and is capable of irrigating 200 acres of cocoanut and cassurina plantation belonging to the Darbar entirely, and the latter, which is constructed and maintained by the cultivators at their own expense, flows up to the end of March in a year of scanty rainfall and up to the end of May in a year of ample rainfall. This Bhadrodi channel is capable of irrigating 400 acres after a season of good rainfall, and in other years about 200 acres. This year the flow is very poor in this as well as in other rivers. In Kundla district a channel has been constructed from the Fulzar river by a masonry dam thrown across the river near Mouze Luwara at the expense of the Darbar. It irrigates about sixty acres of land, and flows up to the beginning of the next rains, but in the latter part the flow is not sufficient for irrigating any crops of the summer season. Ordinary repairs to the dam and the channel are undertaken by the cultivators.

The description of the channel of Talaja district given above applies to the other channels.

13. (1) To the extent of the value of the produce from the irrigated crop. In this part the ordinary custom is to sow rain-crops in all land except under vegetables and sugar-cane. After reaping this out of the same land that which commands a well or channel is prepared for the winter irrigated crop. In the summer, as the channels don't flow, no crops are raised. The rain crops are not irrigated by channels.

(2) To the extent of the relative values of the substituted crops.

(3) (*a*) In a year of ample rainfall the rain-crops (kharif) are not irrigated.

(*b*) In a year of scanty rainfall people may sometimes irrigate the rain-crops by means of channels, but this is not usually done as they do not despair of rains, and hence do not construct the dams early.

Yet if they do, the yield will be 50 per cent. more than the yield by ample rain-water only.

(*c*) The channels don't work in a year of drought.

14. (1) The channels above described commence exactly when they are required for winter crops.

(2) If owing to scanty rainfall the supply ceases too early the value is diminished in proportion to the deficit in the supply.

15. When the flow of the channel is exhausted or becomes insufficient, the irrigation is supplemented by irrigation from wells wherever it is convenient to do so.

16. *Vide* please reply to question 13.

17. In our State the entire proprietary right over all lands vests in the Darbar and the occupants or tenants hold directly under the Darbar. A rate of Rs. 2-8-0 per acre is levied by the Darbar on the area actually irrigated.

18. The average expense per acre to bring the water to the field varies from Rs. 1-8-0 to Rs. 2-0-0, and to prepare (manuring and formation of beds) the land for irrigation the average cost per acre is Rs. 18. This expenditure is borne by the occupants or tenants.

Wells.

34. 1. Statement showing the average depth of wells in the different districts is appended.

2. Wherever there are rocks under the ground water is supplied from springs and in sandy soil from percolation.

(*a*) In ordinary year the supply is not liable to fail or become too saline.

(*b*) In a year of drought the supply does not fail, but in some places where the water is brackish it becomes too saline.

3 and 4. *Vide* statement referred to in (1).

5. By country motes called *kos*.

6. Not fixed, but it generally is from 15 to 20 acres.

7. Four to five acres from a well with the capacity of supplying water by working two motes (*kos*) during the day.

35. The same as question 13. Where the rain-crops are irrigated from a well the increase in the produce is 50 per cent., but the subsequent winter crop in the same land is diminished by 25 per cent. In a year of drought the autumn crops, if irrigated, yield double produce.

After the kharif crop is removed irrigated winter crop is raised in the same plot. The summer irrigated crop is not raised in the same plot in succession, but in a separate plot commanding the same well. Thus they can get one rain-crop and one irrigated crop either winter or summer from the same plot of land.

37. A water-rate of Rs. 5 per acre is levied by the Darbar from the occupant on the area, the supply of water in the well is capable of irrigating, which varies from 2 to 5 acres. This rate is remitted when the well becomes useless, but not when the occupant does not choose to use it.

38. (*1* and *2*). No. In every village people generally know how to find out the course of a sub-soil stream of

water, but when some difficulty arises in the selection of a spot of land in which a supply of water will be obtained, Darbar provides the assistance of an expert who is permanently maintained by the State.

40. In a large majority of cases wells are not constructed with masonry, and yet they stand a long time in soils with rocks underground, but in sandy soils temporary wells are commonly used which serve as a partial protection against drought. The construction of such wells can be encouraged by remission of special revenue charges.

Notes on the Memorandum of points to be considered by the Irrigation Commission.

GUJARAT.

Paragraph 1.—The gross area of the Bhavnagar State is about 1,821,513 acres, of which the culturable area is 1,733,274 acres.

There are no Government irrigation works and neither private nor village works, but there are small irrigation channels supplied by temporary dams thrown across river-beds, which are—

(1) Fullzar Saran, (2) Malan Saran, (3) Bhadrodi Saran, and (4) Navli Saran.

These channels have a capacity to irrigate about 800 acres, and they with the wells protect an area of 53,500 acres, *i.e.*, about 4 per cent. of the whole culturable area—the rest being entirely dependent on rainfall. Sixty-five per cent. of the total culturable area is black cotton soil, 15 per cent. goradu, and 20 per cent. rocky.

Black soil is of two kinds, *viz.*, one mixed with sand and the other without sand and therefore sticky. The former requires more water either from rain or from irrigation than the latter, which cracks or splits when there is scanty water, and for want of moisture the crops are injured; the crops in such soil are also injured in a wet year.

2. There is no demand for water during the south-west monsoon in Kathiawar.

3. The necessity and frequency of irrigation is regulated according to seasons and the nature of the crops and the soil. The following are the chief irrigated crops that are generally raised in the Bhavnagar territory:—

Rice (Padi) requires watering every alternate day when there is scanty rainfall.

Sugarcane crop is sown in February or March and becomes ready in the following January or February, thus during eleven months it requires watering every eighth day during its infancy before the monsoon. During the monsoon it requires watering soon after it has ceased raining, *i.e.*, after a good fall of rain of about two inches it requires watering after 24 hours, and during the cessation of rain every third day and every alternate day according to the nature of the soil.

Vegetables (include sweet potatoes, chillies, onions, brinjals, carrots, mulla) require 14 waterings from September to March.

Wheat is sown in October and becomes ready in February. The land is first ploughed and manured and prepared for sowing. The first watering is given after the seeds are sown, the second after 8 days and the third after 15 days thereafter. After that, each watering is given at an interval of 5 to 7 days until they are ripe. The interval is shortened by a day, when the crop is very near ripening. On the average from 12 to 20 waterings are required according to the character of the soil and the quantity of manure used.

Chhasatio or Juari—Is sown in February and becomes ready at the end of May. For this crop the land is manured and watered twice at an interval of 8 days before sowing. The next watering is given 25 to 30 days after sowing. After that, waterings are given from 8 to 10 days until the grains are ripe. On the average this crop requires from 12 to 16 waterings.

Paragraph 3.—The depth of the black soil is on the average not more than 10 feet, except in alluvial soil. Tanks constructed in such soil are therefore necessarily deeper than 10 feet at which depth layers of yellow soil, muram, rock, etc., are met with. The bed of a tank in such soil takes three or four years to consolidate when it holds water.

There are many small tanks in Bhavnagar State constructed for the watering of cattle and domestic purposes of the villagers. The dams of such tanks are not very high but in all cases made without masonry care-walls. No irrigation is done from these tanks.

Black Cotton soil—Except rice, vegetables and sugarcane, no other irrigated crops are raised in black soil during the monsoon. For other rain-crops (kharif) there is a demand for water only in case of prolonged drought. There has been a desire for irrigation works on the part of owners of black soil and sources of irrigation are considered as remunerative and as important for black soil as for other classes of soil.

Paragraph 4.—Government Irrigation Works.—None

Paragraph 5.—Provincial Irrigation Works.—None.

Paragraph 6.—District or Village Works.—None.

Paragraph 7.—Total area irrigated by wells in ordinary years is 52,700 acres, and in years of drought is nearly 55,600 acres.

New wells constructed on the average annually during the last ten years were 500, making a total of nearly 5,000.

Of these 2,000 wells were constructed at the expense of the Darbar, including 880 constructed during the Famine year alone, and 3,000 constructed by the occupants at their own expense. No water-rate is charged on wells constructed by private capital until the expiry of the term of Settlement which for the current and the first Settlement is 10 years. This term will very likely be made double after the revision of the Settlement.

It is both possible and desirable to stimulate the construction of new wells by a more liberal arrangement.

The capacity of the wells was on the average reduced to half during the famine year of 1899-1900, very few of them were totally dry, all village drinking wells were deepened and 50 per cent. of wells used for irrigation were also cleared of the silt and deepened from 8 to 15 feet. The results in all these cases were satisfactory.

The average depth of water below its surface constantly retained after a year of good rainfall varies from 5 to 8 feet.

A statement showing the depth to which wells are excavated and the cost of excavation and construction in the different districts of the State is appended.

In a greater part of our territory there is rock below certain varying depths of earth and in other parts the water level is reached at less depth than where there is a rock below; both require to be constructed with masonry. The former from the level of the hard rock and the latter through the entire depth, but for want of capital many do without the masonry construction.

The wells sunk in places where there is no rock under ground last for from 2 to 4 years without construction, while those that are constructed last for about 40 years. The wells constructed with masonry in rocky soils last for over 100 years.

Paragraph 8.—Drainage Works.—In black sticky soil not the land but crops alone are injured by excess of water in a wet year, but no special drainage is required for those tracts on sanitary or agricultural grounds.

Paragraph 9.—Works executed by Relief Labour.—94 village tanks were either deepened or newly constructed during the famine year at an expense of Rs. 1,37,357-11-8. None of these are useful for irrigation.

These tanks do not yet properly hold water, but in a year or two hence the beds will be sufficiently consolidated, and improve the resources of the village for watering cattle, etc.

Statement showing the AVERAGE RAINFALL in the different Districts under Bhavnagar State.

Number.	Districts	June.		July.		August.		September.		Average Total.
		Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	
1	Bhavnagar	4	46	8	32	6	92	5	99	25·71
2	Sihor	4	77	6	37	7	35	4	85	23 34
3	Mahuwa	4	70	8	79	6	49	3	0	22 8·
4	Kundla	6	8	6	70	6	53	4	2	23 35
5	Lilia	3	14	6	96	5	50	5	13	20·73
6	Umrala	3	69	5	78	7	16	6	11	22·74
7	Botad	2	36	5	88	6	58	4	45	19 27
8	Gadhada	2	65	5	83	6	84	3	55	18·87
9	Talaja	3	93	8	71	8	60	5	17	26 41
10	Rajula	5	70	7	12	6	38	4	14	23·74
11	Bhal	2	26	7	42	7	4	4	0	20 72
12	Josat	2	80	6	12	9	52	4	79	23·23

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Statement showing the Depth and the Cost of Construction of Wells in the different Districts under Bhavnagar State.

Division and Group of Villages.	Average Depth in feet.	Cost of excavating a Well with two Motes' Power.	Cost of Construction.	Whether supplied from Spring or Percolation.	Duration of Wells (*pakka*).	Remarks.
	Ft. Ft.	Rs. Rs.	Rs. Rs.		Years.	
Kundla.						
1st Division . . . . . Thordi, Vijpadi (South-West).	42 to 52	100 to 250	200 to 400	Spring.	100	
2nd Division . . . . . Other villages.	17 to 27	50	200	Ditto.	40	
3rd Division . . . . . Kerala, Moldi, Amratvel, Nanabhamodra, Juna-Savar.	42 to 52	100 to 150	200 to 400	Percolation.	100	When water of the tanks in the vicinity is dried, water of these wells becomes saline.
Mahuwa.						
1st Division . . . . . Mahuwa Bhadrod, Talgajarda, Ratol, Umaniawadar.	14 to 18	10 to 25	50 to 100	Ditto.	25	
2nd Division . . . . . Other villages.	42 to 52	100 to 150	200 to 400	Spring.	100	
Port Albert Victor.						
1st Division . . . . . Moti Kherali, Mandordi, Babrindhar, Barotana, Nani-Kherali.	42 to 52	200 to 250	100	Ditto.	100	
2nd Division . . . . . Other villages.	42 to 52	150 to 175	100	Ditto.	100	
3rd Division . . . . . Rajula (Proper) (*kacheha* temporary wells.)	17 to 27	5 to 7	...	Percolation.	...	Soil becomes deteriorated by salt efflorescence. They do not make these wells *pakka* (*i.e.*, construct under masonry).
Talaja.						
1st Division . . . . . Zanzmer, Madhuwan, Rajpura.	70 to 90	150 to 200	200 to 400	Spring.	100	
2nd Division . . . . . Other villages.	42 to 52	100 to 150	200 to 300	Ditto.	100	
3rd Division . . . . . (Sea-coast side) Sartanpur, Khandera, Tarasara, Madevpura, Nichadi, Ambla (*kacha* temporary well.)	14 to 18	5 to 7	...	Percolation.	...	These last only for two years. New wells are sunk every third year in different spots.
Botad.						
1st Division . . . . . Botad Tapa, Lathidar Tapa.	42 to 52	175 to 200	250	Spring.	75 to 100	
2nd Division . . . . . Zamrala, Ratanpur, Samadhiala No. 2, Kerm No. 2.	42 to 52	125 to 150	150 to 200	Ditto.	40 to 50	
3rd Division . . . . . Patna, Chackampar, Malpura, Dantratia, Lundhara, Ujalvav, Panvi.	25 to 35	75 to 225	100 to 200	Percolation.	25 to 40	
Sihor.						
1st Division . . . . . Nesda, Vadia (*kachcha* temporary wells.)	10 to 25	10 to 40	...	Ditto.	...	Here we cannel be built *pakka*.
2nd Division . . . . . Tana Tapa, *i. e.*, (Tana and the villages under the same).	30 to 40	80 to 150	250 to 300	Spring.	40 to 100	
3rd Division . . . . . Kunbhan Tapa (*i. e.*, Kunbhan and the villages underi t).	50 to 60	200 to 250	300 to 400	Ditto.	40 to 100	
Gadhada.						
1st Division . . . . . Haripur.	20 to 35	125 to 300	150 to 250	Ditto.	100	
2nd Division . . . . . Gadhada, Janda, Ningala, Ugamedi and Tatana.	35 to 45	125 to 300	150 to 200	Ditto.	100	

Divisions and Group of Villages.	Average Depth in feet.	Cost of excavating a Well with two Moters' Power.	Cost of construction.	Whether supplied from Spring or Percolation.	Duration of Wells (*pacca*).	Remarks.
	ft. ft.	Rs. Rs.	Rs. Rs.		Years.	
3rd Division . . . . . Rahana, Khopala, Pipalia.	45 to 60	125 to 300	150 to 200	Spring.	100	
UMARALA.						
1st Division . . . . . Dhasa and Nerhanvader Tapa.	35 to 45	200	300	Ditto.	100	Soil being rocky excavating a well costs more than in constructing it with masonry.
2nd Division . . . . . Umarala and Sanosara Tapa.	35 to 45	150	250	Ditto.	100	
LILIA.						
1st Division . . . . . Harijar, Hathighad.	15 to 20	30	...	Percolation	10 to 20	Here there are generally *kachcha* temporary wells.
2nd Division . . . . . Sanbhalvada, Khara, Phulsar, Gandotan, Jantrola, Lonka, Lonkoo, Koliana, etc.	35 to 45	170	250	Spring.	100	
DASKROI.						
1st Division . . . . . Bhoomblali, Juna, Ratarpur, Achawada, Malanka, etc.	25 to 35	20 to 40	...	Percolation.	15 to 25	People do not generally make them *pacca* as there is no certainty of water-supply lasting long.
2nd Division . . . . . Other villages of Bhoomblali Tapa.	50 to 60	250 to 300	300 to 400	Spring.	100	
3rd Division . . . . . Villages of Trapaj Tapa.	35 to 60	150	300	Ditto.	100	

1 *Q.* (*The President.*)—You have been employed for the last ten years in the Bhavnagar Revenue Department? Yes.

2. *Q.* You were there during the famine?—Yes.

3. *Q.* What is the population of your State?—412,664.

4. *Q.* What was your loss during famine?—Nearly 100,000.

5. *Q.* (*Mr. Rajaratna Mdlr.*)—Your population of 412,664 is according to the Census of 1891?—No; the recent census.

6. *Q.* What was your population in the Census of 1891? 467,282.

7. *Q.* 55,000 have disappeared and you allow for the increase of population?—Yes.

8. *Q.* You show the average rainfall each year for the last five years?—Yes.

9. *Q.* That includes at least two years of short rainfall? Yes.

10. *Q.* Your rainfall during the previous ten years would have been somewhat greater?—Yes, but not much, the average of the last ten years is:—

4·13 inches in June.
11·24 „ in July.
4·88 „ in August.
0·41 „ in September.

11 *Q.* (*Mr. Muir-Mackenzie.*)—I think in 1900 you had a fairly good monsoon?—Yes.

12. *Q.* (*The President.*)—You say that there are some rivers whose course can be utilised for irrigation purposes, but the intervention of foreign jurisdiction has been an obstacle. Do you consider that obstacle was so serious that it could not be got over?—It is not possible because there are conflicting interests. The States will not agree because they are under the belief that by banding the river water will not be available to both parties.

13. *Q.* Don't you think that any agreement can be come to in these matters?—Yes, that could be done; but some of the States will complain because the villages situated down-stream will be deprived of their ordinary supply of water from the same river.

14. *Q.* Could they not dig temporary wells on both banks and irrigate from them?—That would be inconvenient. It would not be so easy to irrigate. In Bhavnagar some twelve years ago we had to remove a bund made in the rivers.

15. *Q.* Who ordered its removal?—The Political Agent.

16. *Q.* If you were to give water for some days to one State and for some days to another State no complaints would be made by the people?—Many of the villages are situated a long way from the banks, it would be difficult to carry the water to them. Then the villages situated near the banks must be considered; throughout the whole of the year they use the water for household purposes.

17. *Q.* You say the population in some parts is small in proportion to the culturable area?—Yes.

18. *Q.* Is the ryat becoming more intelligent about irrigation since the famine? Do they attach more importance to it?—No, I do not think so. I compared the condition of population in the Kaira District of Gujarat and I find the people in Kaira are more intelligent and industrious and produce much more than the people here.

19. *Q.* (*Mr. Muir-Mackenzie.*)—Is the land superior?—The land in Kathiawar is rich enough, but they have smaller holdings and use more manure in Kaira.

20. *Q.* (*The President.*)—Land irrigated from wells and constructed by private capital is exempted from water-rate for the period of revenue settlement?—Yes.

21. *Q.* How long does the settlement last?—Ten years.

22. *Q.* One man may get exemption for ten years and another for only one year?—That point is not yet settled. The orders are not definite, but under such special circumstances the remaining period of the concession may be made to extend over the next settlement. It is under contemplation to extend the period of settlement to 30 years.

23. *Q.* What do you consider the best means of protecting your State against another famine?—Increased amount of irrigation; some reduction in assessment and reduction

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of expenses of marriage and other expenses. In the course, say, of the last 20 years I think the standard of living has risen and naturally assessment has also risen. The last famine has thrown the condition of the people 25 years back. I think that extensive irrigation will enable them to get good crops and that they will now learn to save.

24 Q You say "extensive irrigation." How are you going to attain that?—By wells.

25. Q. You would give wells the first place?—Yes; because on tanks you may spend a good deal of money but one does not know whether the tanks will retain water in the year of drought; for winter and hot weather crops the tanks will be sufficient, but if the monsoon fails the water will evaporate and will not be sufficient for the next winter and summer.

26. Q. What is the culturable area of your State?—1,333, 274 acres.

27. Q. (*Mr. Rajaratna Mdlr.*)—That is the total culturable area?—Yes.

28. Q. (*The President.*)—Can you say how much is cultivated, one-half or one-third?—Almost all.

29. Q. (*Mr. Ibbetson.*)—The whole culturable area?—Yes. It is only within the last two years that a large portion of the land has remained uncultivated owing to the want of cultivators. Formerly there was very little land uncultivated.

30. Q. (*The President.*)—One single well does not irrigate more than four or five acres?—Not more than that.

31. Q. What is the total area irrigated from wells?—About 53,000 acres.

32. Q. To guard against a similar famine some years hence would you take the precaution of inducing the rayat to make more wells?—Yes.

33. Q. Do you think the State will help him liberally?—Yes. Our arrangements are very liberal. On all wells constructed at State expense the State charges a water-rate. If the well is not constructed departmentally then the Mamlatdar fixes the cost in each locality and the holder takes a contract to make the well; the only condition is that he must dig a well that will have a certain capacity for water. Say one that will supply a *mote* from morning to evening; at first we give him half the money; after the well is constructed he informs the Mamlatdar and satisfies him that the well has been made when the rest is given to him. If he fails to get any water, which is very seldom the case, after he has worked honestly, we don't take the advance back, we write it off.

34. Q. You charge interest for half the advance?—No money is recovered.

35. Q. (*Mr. Rajaratna Mdlr.*)—No interest is charged?—No, nor is the advance recovered; the well belongs to the State.

36. Q. (*The President.*)—Do you think that is a sufficient inducement?—Yes, but I would prefer to advance him money, remit something of the loan and charge no interest.

37. Q. You do that already?—We do not do that; we spend as much money as we are certain the wells would cost; we give a contract to the holder of land himself. When he expends his own money the well belongs to the cultivator himself and no assessment is charged.

38. Q. (*Mr. Muir-Mackenize.*)—You would not abandon the making of wells by the State?—No, if the cultivators do not dig wells then the State should dig them. If cultivators dig a well no assessment should be charged; if they do not undertake to do it the State should be ready to spend its own money and charge assessment.

39. Q. (*Mr. Rajaratna Mdlr.*)—What is the ordinary water-rate that you charge?—For well irrigation Rs. 5 per acre.

40. Q. Does that cover the interest on the advances?—That varies in different localities, but on an average it represents a rate of 10 per cent.

41. Q. In reply to question 35 you say "Where the rain crops are irrigated from a well the increase in the produce is 50 per cent., but the subsequent winter crop in the same land is diminished by 25 per cent." You mean that irrigating the *kharif* crop by wells exhausts the soil and so the following crop is weakened?—Yes.

42. Q. Then you want manure?—Yes; the land is exhausted; one crop following another.

43. Q. (*The President.*)—You say, you have got two kinds of black soil?—Yes.

44. Q. One mixed with sand and one without sand? Does the black soil without sand require irrigation at all?—It does require it.

45. Q. It is irrigated freely, but not so freely as that mixed with sand?—Yes.

46. Q. Have you got irrigation tanks?—We have no tanks for irrigation.

47. Q. (*Mr. Ibbetson.*)—They irrigate the black soil from wells?—Whenever it is convenient.

48. Q. (*The President.*)—You say in paragraph 7, "New wells constructed on the average annually during the last ten years were 500, making a total of nearly 1,000"?—The total is 5,000.

49. Q. Are there any famine relief works going on in Bhavnagar?—No.

50. Q. When were the works stopped?—Towards the end of July 1900.

51. Q. Do you think it is necessary to start the works again?—I do not think so.

52. Q. (*Mr. Rajaratna Mdlr.*)—What are *Girassias*?—They have a share in the revenue. In the Bhavnagar State, we have more than six hundred villages, out of which about three hundred are shared with *Girassias*. They have a share in the land assessment, in the land revenue, in the octroi, and in several other miscellaneous sources of revenue. They have as their share a certain percentage of the revenue.

53. Q. (*Mr. Muir-Mackenzie.*)—They get a share in the revenue of all kinds?—Yes. They were original proprietors who at different times have handed over their holdings to the State.

54. Q. (*Mr. Rajaratna Mdlr.*)—If the revenue increases they get an increased share?—Yes, because they get a fixed percentage of the whole revenue. If you increase a small tax they will interfere and take a share, and the State would have to pay compensation for any reductions. In the trees they have a share. Trees do not belong to the cultivators in Kathiawar; wherever they grow they belong to the Darbar. They have got the right to use the fruit, but not the proprietory right. When the trees die they become the property of the State and the State sells them, and a share of it is given to the *Girassias*, a certain percentage of it. As a rule the State does not grow trees. I may also say that if the ownership of these trees be given to the cultivators they will raise more trees and then they will have distinct interest in increasing the number of trees.

55. Q. You say "notwithstanding the growing desire on the part of the rayat to have means of irrigation at his command he will not exert beyond a four or five acre plot to grow irrigated crops," why will he not do so, if it is profitable to him?—His contentment; they are large holders. Their occupancy rights are complete except as regards their power of alienation.

56. Q. He cannot sell or mortgage if he has sunk his own capital?—Since we instituted the revenue settlement we provide that if the cultivator spends his private capital no assessment will be charged. I do not think they have any sense of insecurity as regards their tenure. The cultivators have no sense of insecurity as regards their occupancy rights. During the last ten years they have been quite ready to take land and improve it at their own expense on the Darbar declaring that no assessment would be charged. Nearly 2,000 wells have been made by private cultivators at their private expense.

57. Q. (*Mr. Rajaratna Mdlr.*)—Do you give any *sanads* in such cases declaring their rights?—No, their names are registered in the register of occupants and that is sufficient.

58. Q. I suppose they know that it is just possible that they may be ejected?—No, there is no sense of insecurity.

59. Q. (*Mr. Muir-Mackenzie.*)—What is the density of the population?—144 per square mile.

60. Q. (*The President*).—You say 412.664; in how many square miles?—2,860 square miles, and in acres 1,821,513.

61. Q. (*Mr. Rajaratna Mdlr.*)—Do you think the construction of wells would be still further encouraged and stimulated by the period of exemption being extended to 30 or 40 years?—Yes.

62. Q. Would it be still further extended if the assessment or water-rate that you charge is reduced from Rs. 5 to Rs. 3 or Rs. 2?—No, I do not think so, if they have sufficient period of exemption.

63. *Q.* You charge a water-rate of Rs. 5 representing interest at 10 per cent.?—Yes.

64. *Q.* Would the State be content with 5 per cent. interest on the capital?—Yes.

65. *Q.* You say there is no canal irrigation in your State?—No. We have got wells.

66. *Q.* The ryat taps the natural springs and sinks wells?—Yes, if you give them a concession of 30 years for any wells, constructed at their own expense. I think no further concession is necessary.

67. *Q.* Is the water assessment in addition to the land assessment?—Yes.

68. *Q.* In the Bombay Presidency they do not charge any water assessment at all; nor in the Madras Presidency. Don't you think the reduction of water assessment would still further stimulate the construction of wells with which the State would be protected against famine?—Any concession will be accepted by the cultivator. The less he has to pay the more he will be encouraged.

69. *Q.* If these inducements are offered will not the ryat be tempted to construct the well on his own account without getting a loan from the State?—Under present conditions a number of people will be quite content to construct wells, and it would be quite sufficient. A man having a small holding will not have more than one well; and if he has two sons and they are a divided family he will have two wells, one for each son.

70. *Q.*—I suppose there are great facilities for extending well irrigation?—Yes.

71. *Q.* Water is found at a small depth and the cost is apparently very small?—Yes.

72. *Q.* (*Mr. Ibbetson.*)—As regards interstatal rights; is it not a fact that under the present arrangement of lifting water from the rivers, only a small proportion of the water of the stream is utilized and the greater part of it goes to waste?—Practically so, but the water of the stream is also used by the people of the villages for domestic purposes.

73. *Q.* You have States above Bhavnagar?—Yes.

74. *Q.* Would you be prepared to come to any agreement with them so as to enable them to make use of that water?—I am not a responsible officer, I could not say.

75. *Q.* You are a Revenue Commissioner?—Yes.

76. *Q.* Do you think it would be possible to come to some arrangement?—Yes; but the States have to provide for their own people.

77. *Q.* So it comes to this that to protect a small portion of the water you let the rest run to waste?—Yes.

78. *Q.* You say you prefer wells to tanks because tanks will not hold water in times of drought?—Yes.

79. *Q.* How many times has there been distress in Bhavnagar from short rainfall in your experience?—There was distress in 1876-77, but not so severe as during the last famine.

80. *Q.* Nothing since until 1900?—No.

81. *Q.* In a year like that tanks will fail?—Yes. We have scanty rain, otherwise tanks would be useful.

82. *Q.* In 1896 in the Central Provinces there was plenty of rain in the early part of the season, but it stopped too soon; yet the tanks were all full?—Yes.

83. *Q.* Do you remember what the rainfall was in 1876 in Bhavnagar?—No.

84. *Q.* You say in preference to the present system of the State making wells you would give advances without interest and charge assessment?—Yes. On the expiry of the period of exemption.

85. *Q.* What assessment would you charge?—Rs. 5 per acre.

86. *Q.* You would keep up Rs. 5 until the money was paid?—I would advance a loan made repayable by easy instalments, charge little or no interest, even remit some portion of it where the exceptional condition of the ryats required it. I would at the same time give them exemption from well-assessment for 20 or 30 years and then charge water-rate at Rs. 5 or reduce it to Rs. 2-8 per acre.

87. *Q.* Supposing that all possible use were made of irrigation from wells, do you think the people would still be exposed to famine?—Yes; the principal thing is that they must learn to save; that is the only cure.

88. *Q.* You do not think wells, however numerous, would give any substantial protection?—No, because the wells require bullocks, and the bullocks require fodder; while the cultivator himself requires food.

89. *Q.* In your memorandum you tell us of three dams; I understand that by means of these the water in the streams is diverted on to the land?—Yes.

90. *Q.* A good deal of the water of the streams passes the dams?—Yes.

91. *Q.* Why do you not make more dams so that you can use the water?—I think there must be some difficulty of levels; I have not inspected it.

92. *Q.* Do you think the people would do it if it is possible?—It would be very expensive to the people to do it; they would not do it themselves.

93. *Q.* Have you got small dams made by cultivators?—If there is one dam here and another dam two miles lower down, I think the dam lower down will not have sufficient water; the streams are not large.

94. *Q.* You think the dams do take up the whole of the water?—Yes.

95. *Q.* You say that in the rains *juari* and food crops are not generally irrigated?—No.

96. *Q.* They do irrigate in the cold weather?—Yes.

97. *Q.* Whenever the monsoon fails they irrigate the hot weather crops?—Yes, they would raise a hot weather crop of *juari*, wherever it is convenient; but in ordinary years if their large holdings give them sufficient grain to maintain themselves and to enable them to pay the revenue, they would not take the trouble of irrigating.

98. *Q.* In reply to *Question* 18 you say "The average expense per acre to bring the water to the field varies from Rs. 1-8 to 2." Does that mean expenses every year?—Yes, because they have to repair the channel each time they irrigate.

99. *Q.* Each year?—Yes.

100. *Q.* How can that be?—Cattle and carts pass over it.

101. *Q.* You say that to manure and prepare the land for irrigation costs Rs. 18 per acre?—Yes.

102. *Q.* For what crops?—Wheat.

103. *Q.* Formation of beds is part of the ordinary agricultural work?—Yes.

104. *Q.* You mean small beds or *kiaris* for irrigation; what is the cost?—Re. 1 or Rs. 2 per acre and nearly Rs. 16 for manure.

105. *Q.* How do they buy manure?—Four annas a cart-load.

106. *Q.* You say "Rs. 2-8 per acre taken is on land irrigated by dams." Is this done if the dam is made by the village?—Whether built by the village or the State one rupee per bigha gives Rs. 2-8 per acre.

107. *Q.* You make no exception where they make their own dams?—No, they pay one rupee royalty as water-rate. They consider the rate a very low one.

108. *Q.* Has any embanking of fields been done in Bhavnagar to hold back rain water?—No, except where there is salt efflorescence.

109. *Q.* Do you know whether this is done in Kathiawar?—I do not know.

110. *Q.* I understand that a well with two *motes* can only irrigate two to five acres?—Yes.

111. *Q.* What are the chief crops irrigated?—Cane, vegetable, wheat and *juari*.

112. *Q.* In what proportions?—Half wheat and half *juari*.

113. *Q.* Is it not generally the case in Kathiawar that the water of a well is soon exhausted and you have to stop working until the well fills again?—Yes, it fills during the night. There are some wells which keep two or three feet of water constantly.

114. *Q.* Can you work all day long with two *kos*?—That depends upon the capacity of the well.

115. *Q.* Working two *kos* the whole day long would only irrigate four to five acres?—Yes.

116. *Q.* (*Mr. Muir-Mackenzie.*)—What crops do you irrigate when you say you irrigate two to five acres? Is it sugarcane?—Yes, four acres of sugarcane.

117. *Q.* Do you irrigate four acres of *juari* and wheat?—Sometimes we get more than five acres of *juari*.

118. *Q.* Would you not crop that area twice?—No, the summer irrigated crop is not irrigated in monsoon, it would impoverish the soil; in the hot weather they irrigate *juari*.

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119. Q. (*Mr. Rajaratna Mdlr.*)—How many waterings are required for *juari*?—Twelve to fifteen.

120. Q. That is one watering a week?—Yes.

121. Q. There is no area cropped a second time in the same year?—No.

122. Q. (*Mr. Ibbetson.*)—Rs. 5 taken for well irrigation is in addition to the land revenue?—Yes.

123. Q. What is your land revenue?—It varies from eight annas to Rs. 8 per acre.

124. Q. It is taken in cash?—Yes.

125. Q. It is not just the same for dry or wet land?—Yes, it is the same.

126. Q. Does Rs. 5 discourage irrigation of food crops, such as wheat, barley and *juari*?—No, for sugarcane we charge special rates.

127. Q. The cultivator can afford to pay Rs. 16 per acre for manure. Does he get such a crop as will enable him to pay also Rs. 5 for water?—Yes.

128. Q. Supposing he were to sow wheat and *juari* and put under irrigation a larger area, would not that pay the State and the people?—Yes. A well with the capacity of one *mote* can irrigate 8 bighas of wheat. The larger the number of wells the greater is the water assessment which is regulated by the capacity of the well to irrigate and not by the area actually irrigated thereby.

129. Q. It seems to me that the high rate of Rs. 5 can only be paid when the crops are exceedingly good; and this you can have only if you use a great deal of manure?—Yes.

130. Q. If you charge a lower rate he will be induced to get a much larger area under irrigation, and you will have more food crops to provide if famine should come again?—Yes, he would sink an additional well.

131. Q. That would be profitable both to the State and the people?—Yes.

132. Q. In your opinion the Rs. 5 rate does not prevent extension of irrigation?—No, they have to pay it whether they irrigate or not. The State supplies them with the means of irrigation.

133. Q. Suppose the cultivator had only to pay Rs. 2-8; that would encourage the further increase of wells?—Yes. The less the burden the greater the facilities.

134. Q. (*Mr. Muir-Mackenzie*)—It would also benefit the State. If a man cultivates double the area and pays Rs. 2-8 the State would be benefited. It would not make any difference if the assessment is fixed. He has to pay the same thing whether he takes one or two crops or irrigates more or less.

135. Q. Rs. 5 is for the whole area attached to the well?—Yes, where he takes two crops we do not charge him twice.

136. Q. Rs. 5 per *bigha*?—Rs. 2 per *bigha*; 6 *bighas* go to 3½ acres.

137. Q. (*Mr. Ibbetson.*)—Are the people afraid of Government demanding a larger share if they increase irrigation?—I have no experience of that. They now pay Rs. 12 for one well for irrigating three-and-a-quarter acres; in the case of a well of two *motes* that irrigates 12 bighas, the State charges Rs. 24. Where they irrigate more the State does not charge them more. The assessment is fixed for any number of crops.

138. Q. Replying to *Question* 38 you say "the Darbar provides the assistance of an expert who is permanently maintained by the State." Are these experts natives of your State?—In several villages there are certain people who know where fresh water is to be found; they find it usually by beholding a strip of land overgrown with green grass. The green grass tells them that a stream passes below. They also find it from the layers of stones.

139. Q. You have heard of tools which enable you to bore a small hole and probe the rock to see what the strata are?—Yes.

140. Q. Have you tried that?—No.

141. Q. Don't you think it would be useful?—That may be.

142. Q. You say "the total area irrigated by wells in ordinary years is 52,700 acres, and in years of drought nearly 55,000 acres." Do you think a number of new wells could be dug?—Yes.

143. Q. Can they be dug so rapidly that they can be used in the same month?—Yes.

144. Q. How many days does it take to dig a well?—Three to four days.

145. Q. The water is near the surface?—Yes.

146. Q. (*Mr. Muir-Mackenzie.*)—Do you dig it for the *kharif* or for the *rabi* crop?—*Rabi*.

147. Q. (*Mr. Ibbetson.*)—It would not be dug to save the *kharif*?—No.

148. Q. (*Mr. Muir-Mackenzie.*)—The soil in Kathiawar is more fertile than in Kaira?—Yes; there is a large tract of good soil in Kathiawar. In Kaira the soil is not very rich, but the people are industrious and use manure, while in Kathiawar there are some fallow lands which would grow a good cotton crop; but they have never yet been manured. There is richness in the soil.

149. Q. Is irrigation useful in black cotton soil?—Yes.

150. Q. Are any wells already made on that soil?—Yes.

151. Q. We have got two contrary opinions on that question. We have evidence that it would be no use digging wells in Broach, as water would not be used for black soil?—We have wells existing and they are used for black soil.

152. Q. (*Mr. Ibbetson.*)—Have you got any other soil? Very little.

153. Q. (*Mr. Muir-Mackenzie.*)—Over the whole of Bhavnagar there is black soil?—Yes.

154. Q. There are two kinds—black and sticky black?—Yes.

155. Q. Do you have wells in both kinds of black soil?—Yes; both.

156. Q. Sandy soils require more irrigation?—Yes.

157. Q. I suppose they never irrigate cotton?—No. Except when cotton is sown in the ground which is previously manured for a sugarcane, wheat or *juari* crop some people take the trouble of irrigating a cotton crop.

158. Q. If after the wheat crop they can get a cotton crop by irrigation, after manuring they would get a three or four-fold yield?—Yes.

159. Q. (*The President.*)—Why do they not irrigate?—Because they are lazy.

160. Q. (*Mr. Ibbetson.*)—They have to pay Rs. 5 per acre?—Yes; they have to pay whether they irrigate or not.

161. Q. (*Mr. Muir-Mackenzie.*)—Can you tell me about this black soil on which irrigation is done; how deep is it; is it very deep?—No; from five to ten feet deep.

162. Q. Below that is rock?—Yes.

163. Q. Any *muram*?—Yes in some places.

164. Q. Do you know what kind of rock it is?—No.

165. Q. You say there is no *muram*?—Very little; mostly rock.

166. Q. You would prefer that Bhavnagar should extend its irrigation by an increase in the number of wells?—Yes.

167. Q. You would not advocate extension by tanks?—No, unless it can be done at very little cost.

168. Q. Would it not be of use in increasing the resources of the people in ordinary years?—Certainly.

169. Q. With tanks would they cultivate wheat?—Yes, wheat and sugarcane; chiefly sugarcane.

170. Q. If tanks were made, the people could go in for high cultivation?—Yes, sugarcane, ground-nuts and other crops.

171. Q. You say that it would be useful to construct tanks in order to increase the resources of the people?—Yes.

172. Q. Have you got favourable sites for tanks?—Yes.

173. Q. You give the area of land irrigated by wells as 53,000 acres; can you tell me what the total number of wells in your State is?—14,000.

174. Q. You have got 2,090 constructed at the expense of the occupants?—Yes.

175. Q. Will not these have to pay Rs. 5 per acre?—Not until the settlement period expires.

176. Q. Supposing the rate taken were Rs. 2-8 per acre, do you not think that they would have dug 4,000 wells?—They might have done so.

177. Q. If you lower down your rates, and if they dig 4,000 wells the State will get as much revenue as it does at present?—Yes.

178. *Q.* And 2,000 more wells would be benefiting the State and people?—Our rate does not prevent them from going in for wells. They borrow and dig wells at their own expense. I have never seen complaints against the high rate of water assessment.

179 *Q.* No complaints have been received against the high rate of assessment and the occupants build the wells at their own cost?—There are no complaints received.

180. *Q.* (*Mr. Ibbetson.*)—The State by reducing the assessment may benefit itself as well as the occupant who will sow a very valuable crop?—The extension of irrigation requires an extensive supply of manure. If they irrigate without sufficient manure, they get a tolerably small yield. The people have an idea that manuring the land for dry crops will not pay them for their trouble. Ordinarily it would appear that they might increase the area if we charged a less rate.

181. *Q.* (*Mr. Muir-Mackenzie.*)—The State would be benefited?—Yes.

182. *Q.* It would add to its general resources?—Yes.

183. *Q.* And the occupant will have two wells instead of one at the reduced rate of assessment?—Yes.

184. *Q.* (*The President.*)—Under any circumstances if a large number of wells were made in a season of drought, you would want a great number of cattle?—Yes.

185. *Q.* Supposing instead of having 54,000 acres irrigated by wells you had 540,000?—If the larger area were under cultivation it would yield the quantity of grain necessary for at least three-fourths of the population.

186. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think that there is any chance in the future of wells being constructed to such an extent?—No; not in the near future.

187. *Q.* (*Mr. Ibbetson.*)—In the Punjab half the cultivated area is irrigated, and half of the irrigated area is watered from wells. Why should that not be the case in Kathiawar?—I have not heard that; there is no *rabi* crop without irrigation in Kathiawar.

188. *Q.* (*Mr. Muir-Mackenzie.*)—What are the principal *kharif* and *rabi* crops of Bhavnagar?—Our *kharif* crops are *bajri*, *juari*, cotton, *til* and gram.

189. *Q.* In your dry crop area they grow cotton year after year without any fallow?—Yes.

190. *Q.* In Broach they go in for leaving land fallow?—Yes.

191. *Q.* (*The President.*)—In Sindh there is a large amount of fallow land?—Here they do not leave it fallow. For cotton, they do not take any trouble; ordinarily they simply scratch the land with the plough; it does not require any weeding.

192. *Q.* (*Mr. Muir-Mackenzie.*)—The yield per acre is not very high?—No.

193. *Q.* How many additional wells were made in the famine?—890.

194. *Q.* Will those wells be maintained and used and repaired?—Yes.

195. *Q.* They will not be allowed by the laziness of cultivators or for any other reasons to fall out of repair?—No, they are not constructed with masonry.

196. *Q.* They are *kachcha* wells?—Yes; but they go into rock and last for 30 or 40 years. They have to be watched every year very carefully, as they are filled with mud and the rain washes down the sides; the mouths become broader. Every year before using them silt has to be removed. *Mr. Gopaldas.* 29 Nov. 01.

197. *Q.* Wells once dug are not likely to fall out of use?—No.

198. *Q.* In times of distress in the Deccan, *kachcha* wells are dug at very little expense; so people won't take the trouble of finishing them or using them; they are too lazy; they do not use them. That is not the case here?—No. It is only in sandy soils where water in the *kachcha* wells is so near and shallow that those wells only last for two years.

199. *Q.* Are there many disused wells in the State?—Not many; they must have been nearly filled up.

200. *Q.* One difficulty in bringing them into use is that you would require cattle?—Yes.

201. *Q.* You can dig your wells very quickly?—Not all; only wells in sandy soil.

202. *Q.* How long does it take to dig a well on an average?—A month.

203. *Q.* If a cultivator had fodder enough to keep cattle alive for a month, would it be worth his while to dig a well, and would he then be able to keep the cattle alive?—Yes. But some starvation is experienced before grass or fodder grows up.

204. *Q.* What is the difficulty in supporting cattle in the famine year when there are wells?—In the first place in the famine the fodder is exhausted. My experience of the last famine is that during the latter part of the monsoon many people sold their stock of fodder at high prices were realized, in the hope that a late rain will give them fresh fodder. At the same time they did not irrigate their withering crops in the same false hope of rain.

205. *Q.* Are there any forest lands?—No, but in every taluka there are large *birs*.

206. *Q.* From these you cannot get fuel?—No, it is not allowed.

207. *Q.* Would you advocate the growth of *babul* in order that the people may use *bir*-fuel instead of cutting?—What I would advocate is to allow the occupants to put *babul* trees in their own occupancy lands on the borders; *babul* trees are not injurious to crops.

208. *Q.* Would you advocate growing of *babul* trees by the occupants themselves?—Yes.

209. *Q.* What inducement would you give them?—Their proprietory rights in the wood.

210. *Q.* Is your State near the sea?—Yes.

211. *Q.* Do you use sea-weed for manure?—No.

212. *Q.* (*Mr. Ibbetson.*)—Cane and vegetable take a great deal more water than wheat or *juari*?—Yes. Sugarcane most.

213. *Q.* The well that irrigates four or five acres will be half in cane or vegetable and half in wheat or *juari*?—Yes.

214. *Q.* Suppose it had to irrigate only wheat or *juari*, how much would you irrigate?—Six acres.

215. *Q.* Wheat and *juari* would not be so valuable as cane and vegetable?—No.

216. *Q.* (*Mr. Muir-Mackenzie.*)—You gave very good evidence?—Thank you, Sir.

WITNESS No. 27.—MR. J. J. B. BENSON, State Engineer, Porebandar, Kathiawar.

Memorandum by Witness.

1. *Bhavsingji Bhadar Weir and Irrigation Works.*

The area of the catchment of the river Bhadar being over 4,000 square miles, of varied nature, hills and plains, trap rock and alluvial plains, the perennial flow fed from springs rarely fails. This year, however, the flow stopped in November and in 1899 it stopped in February. It has not before failed so far as can be ascertained since the famine of 1878. *Mr. J. B. Benson.* 29 Nov. 01.

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The flow gauged at times in six years is given below:—

Date of gauging.	Cubic feet per second.	Due to the rainfall of	Remarks.
14th March 1892	175	35·93 in 1891	
20th May 1892	80		
26th May 1893	100	36·56 in 1892	
25th February 1894	185	31·81 in 1893	
15th March 1894	115		
18th April 1894	110		
11th December 1894.	550	48·31 in 1894	
12th March 1895	193		
31st December 1895.	310	17·86 in 1895	
March 1896	90		
May 1896	50		
5th June 1896	150	26·07 in 1896	
15th December 1896.	325		
15th January 1897	225		
15th February 1897	125		
15th March 1897	100		
19th April 1898	110·44	37·09 in 1897	
February 1898	River dried	5·00 in 1898	
1st December 1899	600	70·00 in 1899	
15th November 1900.	River dried	15·00 in 1900	

Assumed annual rainfall in the valley of the Bhadar is 30·69 inches, the average for fifteen years 1886—1900. This has been arrived at from averaging the fall in four stations in the valley of the Bhadar, *viz.*, Jasdan, Gondal, Jetalsar and Dhoraji. If the fall at Junagadh were included it would raise the average to 37·35, but as the heavy fall is very local it is not fair to include it in the average for the whole catchment area. Capacity of river bed is 110 million c. ft., but this is little more than a week's cold-weather flow in a normal year. It is essentially necessary to have this storage, as during holidays the water would be run to waste. The cost of the work has been 3 lakhs of rupees.

2. *Canals and distributing Channels.*—There are natural canals aggregating 20 miles in length, from which distributaries will be led hereafter as the Mokal Rann is cultivated. It is only the Mokal Rann which can be irrigated by direct flow from canals. All the upper lands (12,000 acres) are irrigated by lifting the water by *Koses* and centrifugal pumps driven by oil engines. The lift averages five feet at the beginning of the cold season.

3. *General observations.*—It has been found by most accurate observations that 100,000 c. ft. per cold-weather crop of Juari is required per acre. This quantity is seldom exceeded when the cultivators lift it themselves and do not waste it. To lift this quantity of water *loses* 5 c. ft. in capacity are used.

An ordinary speed of lift which can be kept up 9 hours a day is:—

Number of lifts.	Depth of lift.	H. P.	Cubic feet per hour discharged.
(a) 60 per hour	2½ ft lift	= 27	300
(b) 72 "	2½ "	= 227	361
(c) 94 "	16 "	= 423	470
(d) 120 "	5 "	= 112	900

The (*a*) case was observed in the Vartu Valley. The work continued 90 days and therefore:—

5 c. ft. × 60 lifts per hour × 9 hours × 90 days = 243,000 c. ft. on 2½ acres = 100,000 c. ft. per acre nearly.

(*b* and *c*) were taken before Bhadar weir was built and irrigation proceeded at low tide on the upper reaches of river.

The area irrigated increases as the lift is reduced. The above table shows that for very small lifts the full power of the bullocks is not utilized. This is because such a large part of the time is taken up to fill and empty the *kos* 180 times.

4. Khambhala Tank. (*Nearly completed.*)

Area and nature of catchment, 11 square miles of hills ranging in elevation from 500 to 1,000 feet. Much is very steep and nearly the whole area is rocky. *Assumed average rainfall,* 36 inches. The Porbandar average for the last 15 years is 21·5 inches. Ranawa average for 11 years is 25·16 inches. *Full supply capacity of Tank,* 553 million c. ft. *Percentage of capacity on assumed rainfall,* 50 per cent. *Water spread at full supply,* 1·31 square miles. *Maximum height and total length of dam,* 82 feet height from core wall foundation, 1,900 feet length of top of dam. *Cost of dam, waste weir sluices* will not exceed Rs. 2,15,000. Dam is up to full water level and is proceeding at the rate estimated. Waste weir is chiefly rock cutting by contract and is approaching completion. *Compensation for land submerged by tank,* not paid as owned by the State. An area of 400 acres was submerged.

Cost of canal and distributing channels.—The canal is designed to pass 50 c. ft. a second or sufficient (assuming 100,000 c. ft. per crop per acre) for 1,800 acres. Monsoon crops (rabi) as well as cold-weather (kharif) will be irrigated and the water required for the former will be much less and will vary with the amount of rainfall. It will thus be seen that with the two season crops at least ⅔rds of tank capacity will be utilized which is probably what will be required. *Total capital cost.*—The State accounts are not kept to show precisely interest of expenditure on a work during construction, etc., etc. The estimated cost may be taken as . . . . . Rs. 2,20,000

10 per cent. during construction	"	22,000
Establishment . . .	"	8,000
Assumed total capital cost .	Rs.	2,50,000

5. *The area of arable land* is 216,941 acres. There are 4,310 wells in the State. Further, there is the Bhadar river weir, and rivers Vartu, Minsar and Sabli and smaller streams from which water is utilized for irrigation. If the whole means of irrigation were utilized an area of 31,000 acres could be irrigated—nearly 12 per cent. As the Mokal Rann comes under the plough this will be increased to 60,000 acres in all.

6 *Irrigation by pumping* on the river Bhadar (to which detailed reference is made elsewhere), two 16 B. H. P. Oil Engines are pumping by means of a 10" and an 8" centrifugal pumps. The 10" centrifugal pump discharged 300 c. ft. a minute, and has been worked 663 hours from October 16th to December 20th, giving two waterings to 204 acres. The following shows the quantity in cubic feet distributed on the land. The crops will stand 100 days and therefore nearly an equal quantity will have to be given.

$$\frac{663 \text{ hours} \times 60 \text{ minutes} \times 300 \text{ c. ft.}}{2} = 54{,}000 \times 2.$$

= 1,08,000 c. ft. per acre.

The actual cost has been as follows:—

	Rs.
Labour, preparing, conveying and erecting engine	290
Establishment, 2 months . . .	123
Belting	101
Oil 75 cases of 65 lbs. each . .	263
Miscellaneous charges . . .	107
Irrigation canals	200
	1,087

To this must be added for the remaining months:—

Establishment 3 months . . .	122
Oil 75 cases	263
	385
5 per cent. on cost of engine and pump about Rs. 5,000 . . .	250
Miscellaneous charges . . .	100
	735
	1,087
	1,822

$\frac{\text{Rs. } 1{,}822}{204 \text{ acres}}$ = Rs. 8·9 per acre.

108,000 c. ft. of water per acre per crop—204 acres—irrigated at a cost of Rs. 1,822. The quantity lifted 10 feet = 12,105 c. ft. per rupee.

1. Q. (*The President.*)—You have had 11 years' experience at Porebandar?—Yes.

2. Q. You give us an account of a river?—The Bhadar river: it is the largest river in Kathiawar.

3. Q. You took these gaugings which you give us yourself?—Yes, in every case; Mr. Whiting took a few of them with me; he consulted with us; we measured it together; he was in the Bombay Public Works Department.

4. Q. You had a flow of 600 cusecs in December 1900?—Yes: in that year excessive rain fell in Kathiawar.

5. Q. What is the population of your State?—I think 75,000.

6. Q. Did you suffer very severely in famine?—Not as severely as other States: ours is a small State and we were able to keep our eye on every part.

7. Q. You say "there are natural canals." I suppose the irrigation is by lift?—Yes, except in the Runn.

8. Q. The land is at the sea level?—It is 6 inches below high tide level and our water is held up a foot and a half above that level.

9. Q. What is a *koss*?—A leather water bag for lifting.

10. Q. You go into the question of lifting by steam power; have you got steam engines belonging to the State?—Yes, we are using two sixteen horse-power oil engines and water-pumps.

11. Q. The average lift is five feet?—Where we have placed the engine the lift is 9 feet, because water has gone down four feet.

12. Q. You lift from the canals?—We lift directly on to the fields.

13. Q. From the river beds?—Yes.

14. Q. I do not quite understand your table here?—These are very precise observations as to speed of water lifts; 60 lifts means 60 bags full.

15. Q. (*The President.*)—For pumping what oil is used?—Any oil; at present we have got a brand which is the same as bull oil; it is from Graham and Co.; it is Russian petroleum.

16. Q. You say "the actual cost of pumping has been Rs. 1,821;" does that cover depreciation?—No, I think that the machinery will last for twenty years. The engines are extremely durable. They do not wear out: we have been working them three years and they have never been repaired.

17. Q. (*Mr. Muir-Mackenzie.*)—The crop irrigated four times at a cost of nine rupees per acre was *juari*?—Yes; wheat does not want so much water.

18. Q. (*The President.*)—You say "there are 4310 wells in the State; what is the average area irrigated by each?—About 3 acres.

19. Q. Is the small area due to the laziness of the people?—Well, the thing hinges on the number of lifts per hour. They cannot do more.

20. Q. The wells are not deep?—No; the wells are chiefly along the sea coast and are shallow—eight or ten feet among the cultivators.

21. Q. You say "if the whole means of irrigation were utilized 31,000 acres could be irrigated?"—Yes; but more than that will be irrigated when the Mokal Runn is culturable. The area of the Runn is 5,089 miles, and eventually it will be all culturable. It is not so now?—We don't call land culturable until it is actually cultivated.

22. Q. You speak of the Khamballa Tank; do you think it is worthwhile to make a tank which will fill every third year or second year?—Yes.

23. Q. What is the present state of that work?—It is practically finished. We shall completely finish it in two months. It will irrigate 5,000 or 6,000 acres. I propose to use water chiefly in the monsoon to take the place of short rainfall.

24. Q. The cost is Rs. 2,10,000?—Yes.

25. Q. Does that represent all that has been done by your State for irrigation?—There are many minor works to which no reference is made. There are many small tanks which are enumerated in the printed list submitted to the Agency. There is an indirect benefit but no profit to be derived from them.

26. Q. When you have finished these works do you consider that your State will be protected from such a famine as happened the other day?—No; we should put more tanks on the hills; we have many magnificent sites for tanks. We found there is a flow in the sub-soil water from the Barda Hills to the sea, a distance of ten miles; there is flow even in times of famine; if these tanks are made it will still further increase the flow. Five or six big tanks can be made in the hills.

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27. Q. If it is proposed to use flood water up above, would your State object?—It is an extremely intricate question. The State would not object to flood water being used up above if strictly limited to flood. By multiplying tanks in the hills the sub-soil water could be raised.

28. Q. What is the State next above you?—Junagadh, Gondal and Jamnagar.

29. Q. (*Mr. Muir-Mackenzie.*)—Tanks on these hills would be of use only to you?—We only contemplate making them; if we do, they would be useful only to us.

30. Q. (*The President.*)—Have you got any surveys in hand for future tanks. Are the State resources exhausted?—The State resources are not exhausted. We have had rough surveys made some years ago. The Khamballa Tank survey was made seven years ago and the famine compelled us to complete the work. We know every inch of our State and every possibility of irrigation.

31. Q. You spent Rs. 3,20,000 on famine relief works last time?—Yes, that does not include gratuitous relief; it was all spent on works.

32. Q. Have you any need to start work again?—We find there are not sufficient labourers in our State now to do our work. We have got 700 men from Rajkot State on the Khamballa Tank.

33. Q. (*Mr. Ibbetson.*)—I understand you are now importing cultivators for the Bhadar?—Yes.

34. Q. You are getting on fairly well?—I think so. They do not come through me; there is a special officer.

35. Q. What crops are cultivated in the Runn?—Almost solely *juari*.

36. Q. What is charged for the irrigation?—As a matter of fact there are many different rates of charges. I can give you an instance: they only charge 10 annas per acre for water if the cultivators lift it themselves and the State takes less share from the irrigated land than from monsoon crops; ⅛th instead of ¼th. It is really to their benefit to irrigate.

37. Q. They pay 10 annas per acre for lift?—If we delivered water we took a share of the crops. Ten annas is one instance; the charges varies; for pumped water the State takes ¼th of the produce, instead of the usual ⅛th.

38. Q. Do you know the maximum rate?—It is Re. 1-8.

39. Q. That is the maximum?—Yes.

40. Q. There is nothing like Rs. 5 or Rs. 2-8?—No.

41. Q. Do you allow people to use manure in their crops?—Manure is never used in the fields subject to floods from the Bhadar.

42. Q. Silts takes its place?—Absolutely.

43. Q. Does the weir pay well?—Handsomely: it will pay for itself in two or three years.

44. Q. People irrigate the soil and bring the whole of it under cultivation?—Every single pair of bullocks is engaged.

45. Q. Was there a severe loss of cattle in this State?—Yes, about 30 per cent.

46. Q. Your cost of pumping comes to Rs. 10 per acre to irrigate *juari*?—Yes, by oil engine power.

47. Q. One-fourth of the produce pays you?—I am not perfectly sure; but the Revenue Department say that it returns a handsome profit. I cannot say what the value of the crop would be; it grows eight to nine feet high. All these figures can be worked out, printed, and supplied to the Commission if you wish.

48. You say that the State "do not use the whole of the water"? I refer to the Vartu river with hesitation. This case has been disputed 30 or 40 years and is still before the Political Agent.

49. Q. Is that water wasted or used?—It goes direct to the sea, into the tidal creek.

50. Q. What are the prospects of storage of water?—Our Rana Sahib is quite willing to store if the adjoining State has no objection.

51. Q. You made a tank which will cost two lakhs to irrigate 5,000 or 6,000 acres. What are you going to charge?—The State will charge nothing, nor will it make any

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restrictions for the use of water because it takes its share of all crops grown.

52. *Q.* Will that pay?—Undoubtedly; because not one year in four do we get monsoon which ensures full crop.

53. *Q.* Of what?—Monsoon crop—*juari*. It pays well to irrigate *juari* even in monsoon.

54. *Q.* You can afford to spend two lakhs for 6,000 acres?—Certainly.

55. *Q.* Will you make these tanks simply in order to raise the subsoil water?—We will raise the level of the subsoil water and also utilize the direct flow from the tanks.

56. *Q.* Do you pay your labour according to the market rate?—Yes; labour is very cheap.

57. *Q.* No forced labour?—Certainly not.

58. *Q.* (*Mr. Muir-Mackenzie.*)—In British territory we could not make such a tank for two lakhs?—Mr. Little told me my estimates were ridiculous; he said seven lakhs was correct for the Bhadar weir. We do our masonry work for Rs. 18; materials are cheap in Porebandar.

59. *Q.* (*Mr. Ibbetson.*)—Can private individuals work at the same rates?—In our small State we work more like private individuals; we have many advantages.

60. *Q.* (*The President.*)—What is the span of the arches of the Bhadar weir?—Twenty-five feet.

61. *Q.* You hold eight feet against this weir?—Up to nine feet.

62. *Q.* There is no leakage?—Not the slightest.

63. *Q.* (*Mr. Muir-Mackenzie.*)—Is the distribution controlled at all by you, or do the cultivators take it exactly as they wish?—They take it as they like.

64. *Q.* A great number of water lifts exists along the bank of the river?—Yes.

65. *Q.* That does not diminish your supply?—This year the supply would not have been diminished had there not been a short rainfall; the lifts above dried up the river completely.

66 *Q.* The river was absolutely dry?—It was dry before the 15th November.

67. *Q.* In ordinary years it would not appreciably diminish your supply?—No.

68. *Q.* Do you think you would not get sufficient supply if a bund were put somewhere above?—That would stop the whole supply completely.

69 *Q* You think that it cannot be put at any part of the river without injuring you?—I am afraid it would completely ruin us.

70. *Q.* (*The President.*)—You have some storage?—Only for a few weeks' irrigation. We tried our utmost to get storage and we have not succeeded. Mr. Whiting from Bombay, who came here could not find a place where we could make a tank. We cannot possibly store. We depend entirely on the perennial flow; any bund closed in the cold season would ruin us.

71. *Q.* (*Mr. Muir-Mackenzie.*)—A great part of this Runn land was salt?—Yes, floods are annually sweetening it.

72. *Q.* Would it be safe to conclude from that, that the saline *efflorescence* will be remedied by bund and irrigation over a considerable tract?—Drainage is absolutely necessary; we have a very big drain.

73. *Q.* The Khamballa Tank will not fill in a year of small rainfall?—It requires actually 20 inches of run off to fill; a rainfall of under 30 inches would not fill it; that is a minimum rainfall; I think it requires 36 inches of rainfall to get sufficient run off.

74. *Q.* How far are these hills from Porebandar?—Ten miles.

75. *Q.* Does a tank have the effect of raising the level of the subsoil?—It is a well-known fact that if water is held up in the bed of the river it temporarily helps to raise the subsoil water. We have several instances in the case of the river Ojat which is a branch of the Bhadar.

76. *Q.* I do not quite understand how you raise the subsoil level in the plain by a tank in the hills?—The subsoil water is unquestionably raised even in a flat country by impounding water in a stream.

77. *Q.* The instance you have given is of subsoil water being raised within your dam?—Yes, in a very flat country, where the subsoil water is fairly level.

78. *Q.* Would it also rise below your dam?—I think it would; we can conclude that from the springs being filled from the hills.

79. *Q* (*The President.*)—Does high tide affect your dam?—It does not rise higher than a foot and a half below the full supply fresh water level.

80. *Q.* You have got no large head of water on the dam?—Only a foot and a half at highest tide and 8½ feet at low tide.

81. *Q.* What is the tide?—The mean range is 7 feet.

82. *Q.* (*Mr. Rajaratna Mdlr.*)—You said that the cost of raising water by means of oil engines would amount to Rs. 10 per acre?—Yes, for the complete crop.

83. *Q.* Is not the cost rather high, much higher than in the case of ordinary lifts by *motes*?—Unquestionably; but bullocks are scarce and therefore they cannot afford to use *motes*.

Witness No. 28.—Mr. E. O Mawson, Executive Engineer.

Replies to Printed Question.

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General.

The following notes refer to Kathiawar, more particularly to the central portion of the district. I served in Kathiawar for 2½ years as Agency Engineer and had ample opportunities of becoming acquainted with the district, especially during the late famine. The rainfall varies considerably, being about 80 inches near the Girnar Hills and about 22 inches in the north-east, but excepting the small area with high hills, the average rainfall over the whole district is from 23 to 27 inches per annum. In the famine year the rainfall was only about 5 inches, while in the following year it was nearly 40 inches. The chief obstacles to the extension of irrigation are the lack of capital for initial expenditure and the fear of enhanced revenue assessment; the latter being due to the fact that irrigation from tanks has only been recently introduced, will probably soon vanish, but the lack of capital will remain a permanent obstacle. The soil is as a rule good, and, over large tracts, excellent. There is a temporary dearth of cattle due to the great mortality during the late famine, but a few years will remedy this. During the short time irrigation has been introduced into Kathiawar there has been no sign of injury to the remaining cultivation; the area so far irrigated is so small that this question would not arise for many years even if the irrigated area was increased tenfold. There are no canals with continuous flow, nor are there any parts of the district where such canals could be constructed. The only intermittent flow canals are small irrigation channels deriving their supply from streams temporarily bunded by very small earthen dams. These dams are washed away every rains and re-made year by year. Such channels are rare and can only be constructed in a few favourable situations, because in Kathiawar, owing to the soft and friable nature of the upper layers of the muram immediately underlying the soil, the beds of the streams are generally from 10 to 15 feet below the surface by the time the nullah has attained a sufficient length to have a discharge suitable for irrigation. These small intermittent channels are entirely managed by the rayats; as a rule, the supply is maintained long enough in the cold weather to permit of wheat or barley crops being grown. Such irrigation may be taken to increase the net return due to the produce of the land by about one-half in a year of either ample or average rainfall, as however ample the flow it will go to waste after the cold-weather crop is reaped. In a year of drought there would be no water so near the source as these works are now situated. There is no fixed charge per acre irrigated, as these works being in Native States the recovery is by share of crop.

Tanks.

The tanks in Kathiawar are all formed by bunds of masonry or earthwork thrown across rivers, and they are supplied with water by the run-off from the catchment area during the monsoon. The water is distributed to the land by canals, from which small channels are taken off at intervals, these channels again branching as required by the nature of the ground. Irrigation has only just been started in Kathiawar and the tanks are designed to irrigate cold

weather crops in years of average rainfall or to protect the rain crops in years of scanty rainfall. In average years no water would be required during the monsoon and the hot weather and perennial crops will be so small as to be a negligible quantity. The irrigation increases the value of the produce of the land by the substitution of more for less valuable crops in years of ample rainfall and by preserving the rain crop and thereby increasing the yield in years of scanty rainfall. In ordinary years the irrigation is not supplemented by wells, but in years of drought wells would be used. During the late famine, when the water in the Lalpuri Tank (then the only irrigation work) was nearly exhausted, all the old wells were used to supplement the tank supply. Owing to the ground being saturated by the two previous years' irrigation, the wells were, due to percolation, in a much better condition than previously. The sub-soil water level had risen and the wells held out to the end of the famine. In the case of the Lalpuri Tank the rate per acre varies from Rs. 5 to Rs. 11 per acre for water rate according to the class of soil. The cultivator may grow what, and as many, crops per annum as he likes. On all the new tanks constructed during the famine the rates have been fixed according to the crop grown. At Lalpuri the rate is paid on the irrigable area to which water is supplied; on all new works the rate is charged only for the crop and area actually cultivated and irrigated. The private expenditure to bring the water on to the land is practically *nil*. All the cultivator has to do is to make the small distributing channels and this is part of his ordinary field labour. The annual average rate per acre for water amounts to about Rs. 4-8 to Rs. 5-8 according to the situation and soil. In the Thanas this rate is fixed for each crop in cash. In independent States the water-rate is taken in an enhanced share of crop. But all round it comes to about Rs. 5 per acre. This rate is nearly always levied on the actual area irrigated. The irrigable land in Kathiawar is as a rule nearly level and there is practically no expenditure required in preparation for irrigation except the small cost of constructing the *dorias*. The main expense of the canal falls to the landlord, the small labour of making the *dorias* on the rayat. There is practically very little silt clearance or repairs necessary. For the Main canals this falls on the landlord; while on the small *dorias* it will form part of the ordinary field work of the cultivator. In all independent States the Chiefs make such regulations as they deem proper for the distribution of water and realisation of revenue. Irrigation in Kathiawar is in its infancy, but I have never heard of a case of a cultivator appealing against his assessment in independent States. Up to the present, famine has been almost unknown in Kathiawar. Government assistance is *urgently needed* to bring into full operation the works partially constructed during the late famine, both in the Thanas and small States. No legislation appears necessary; what is wanted is *funds* to complete the works already nearly finished so as to make them remunerative. There are very many sites at which remunerative and protective tanks could be constructed, but the lesser Chiefs and land-holders are very poor, and without Government aid nothing can be done. As regards the silting of tanks there is no precedent to quote except the small tank at Randerda near Rajkot. This tank has hardly silted at all. Judging from the water brought down by nallahs and streams in flood, there does not appear to be any fear of excessive silting. Allowing for the difference in level between the bed of the bunded stream and the outlet, it is probable that the tanks will not silt up to outlet level for at least three generations, even if then. Except in occasional and very heavy rains very little debris is carried down by the rivers and so far as Kathiawar is concerned, the silting up of the tanks may be left out of the question when estimating their value either as paying irrigation or protective works. The country is admirably adapted for small irrigation tanks, as it consists of bare muram hills with good black soil valleys. The muram hills give excellent sites for reservoirs, while the valleys, nearly level, offer exceptional opportunities for distributing the water. The one item necessary is funds to carry out suitable works. In Kathiawar the staple crop irrigated is wheat, while the principal rain crop grown without irrigation is *juari* and in poor soil *bajri*. The effect of irrigation is to convert the *juari* cultivation into wheat crops. The net profit per acre to the rayat, after paying revenue assessment or *rajbhag* and allowing for all out-going expenses, is from Rs. 7 to Rs. 10 per acre, while the net return on irrigated crops averages about Rs. 20 per acre.

Wells.

The average depth of wells used for irrigation is about 35 feet. In the north-east of the district at Wadhwan and near the Ran of Cutch the wells are brackish, especially in years of scanty rainfall. In the rest of the district the wells are sweet and there is a considerable amount of well-irrigation. The cost of construction varies very much. A good well 30 feet deep, the top ten feet of which would have to be built up with masonry, would cost about Rs. 2 000; but there are many wells, where the muram is near the surface, which have not cost more than Rs. 400 to Rs. 700 including all apparatus for drawing water. Beneath the black soil the whole district consists of porous muram, and the supply to the wells is by percolation. Thus all irrigation wells are situated in the flat land between two ranges of rising ground. A well once dug practically lasts for ever; the only repair necessary is for the top masonry. The water is always raised by *mote*. The area irrigated from each well varies from 2 to 10 acres and the land commanded is approximately double these figures. Well-irrigation practically doubles the value of the produce of the land by leading to the substitution of wheat or barley for *juari* and *bajri*. In years of drought the water level sinks considerably, but the extra labour in raising the water is compensated for by the increased value of the grain and also by the value of the stalk as fodder, which as a rule is not taken into account in ordinary years. On well-irrigation there is no special rate. The Darbar gains equally with the rayat owing to the revenue being as a rule collected in kind. Each State has its own rules as to the share taken by the Darbar from well-irrigation, and these shares vary with the manner in which the well was constructed, *i.e.*, whether the cost was met by the State, by the rayat, or by combination. Temporary wells were dug during the recent famine, but they were not very successful. They are not much protection against drought, as by the time the well is sunk it is too late to sow any crop. The supply being entirely by percolation, when there is short rainfall the sub-soil water level falls and the wells are apt to run dry just when most wanted.

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1. *Q.* (*The President*)—I understand you were formerly 2½ years in this province?—Yes.

2. *Q.* You came here specially in connection with Famine matters?—No, I came here in June; famine declared itself by August.

3. *Q.* You handed over your place to Mr. Davies?—Yes.

4. *Q.* (*Mr. Ibbetson*)—Where are you stationed now?—I am Executive Engineer, Poona

5. *Q.* You say in your memorandum "the chief obstacle to the extension of irrigation is the lack of Capital." Is there a strong wish to have irrigation?—I think many of the people would be very glad to have extended irrigation.

6. *Q.* If they can get loans for the purpose from Government?—Yes.

7. *Q.*—Would they take takavi loans?—Probably, but there is the great obstacle of the intermingling of States.

8. *Q.* I suppose you mean that any large scheme would require previous agreement with the different Chiefs?—Yes. The surplus water of a canal would perhaps go into a State which would refuse to pay for it. We have had to keep many of our tanks very small, so as to confine the water to one State, though many of the tanks could have been made much larger with advantage.

9. *Q.* How do you arrive at the figures of rainfall given in your statement?—I take the mean between the average and maximum rainfall for ten years.

10. *Q.* You might have stored more water than you did?—Yes, very much more.

11. *Q.* You were limited by financial considerations?—Yes, I tried to get the tanks as near as possible to the places where the famine works were required.

12. *Q.* Are the works that you made capable of enlargement?—I am afraid not more than two of them are capable of enlargement.

13. *Q.* Should not tanks be made so large as to hold a maximum supply of water?—Each case should, I think, be considered on its merits.

14. *Q.* From the point of view of this commission, the main thing is to see what can be done to meet a future famine?—Famines are very rare here. For about 70 years we had no real famine. These last two or three years have been bad, but probably there will not be anything similar for another hundred years.

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15. *Q.* What do you think would be the best means of making Kathiawar strong to resist famine, should it again occur?—The best or at least the cheapest plan would be not to attempt to protect the country, but to put by a certain sum every year for carrying out works when a famine occurs—in fact Famine Insurance fund.

16. *Q.* If there were tanks would the water be fully utilized?—I think it would.

17. *Q.* We have evidence that there is practically no *rabi* cultivation without irrigation?—Practically none.

18. *Q* I suppose there are a great many possible sites for tanks?—Yes, there are many good sites where tanks could be made, but inter-statal arrangements interfere.

19. *Q.* If one could get over that difficulty, by spending a certain sum of money a very large area might be added to the valuable cultivation of the province?—Yes.

20. *Q.* It would probably be done without much loss even if it did not pay good interest?—I think it would pay about 4 per cent. or 5 per cent on the cost, but some of the States are so poor that they would have to borrow the money to build the tanks.

21. *Q.* Supposing all the possible tanks and wells were made, how far would the country be protected?—Perhaps 10 per cent.

22. *Q.* That is by tanks?—Yes.

23. *Q.* You would have to add another 10 per cent. for wells?—Hardly, wells are apt to fail when most required.

24. *Q.* (*Mr. Muir-Mackenzie*)—Did the wells give out in the first year of famine, 1899-1900?—Yes; and consequently the cultivators did not get full crops; they got about a ten-anna crop.

25. *Q.* (*Mr. Ibbetson*)—Ten annas on the full area irrigated by the well?—Yes.

26. *Q.* (*The President*)—Do you know the Bhadar river?—Yes.

27. *Q.* Are there any suitable sites for making tanks in the hills?—Yes.

28. *Q* So that without doing any harm to Porebandar, we may probably find a way for benefiting all the country above Porebandar?—The requirements of the States higher up the river could be met, but you cannot put tanks in one chief's territory without opposition from the adjoining territory.

29. *Q.* It might be done by strong diplomatic pressure, or if the people themselves are impressed with the importance of irrigation?—Yes.

30. *Q.* Have you been looking after the famine relief works over the whole province of Kathiawar or only in British territory?—I had charge of the Thanas or groups of small States, and also looked after the works in four independent native States; the other States Junaghad, Bhavnagar and Jamnagar made their own arrangements.

31. *Q.* Previous to the Famine there was practically no tank irrigation?—Only at Rajkot.

32. *Q* Irrigation is not one of the old traditions of Kathiawar?—No.

33. *Q.* (*Mr. Muir-Mackenzie*)—Are there no disused tanks?—In Jasdan State there are two or three old tanks. There is another old bund in Junaghad.

34. *Q.* What is the meaning of "*doria*"?—A small water channel about two or three feet wide.

35. *Q.* (*The President*)—Your dams are I suppose earthen?—Yes.

36. *Q.* Was famine labour employed on the earthwork?—Yes.

37. *Q.* How did the cost compare with ordinary Public Works Department rates?—About 30 to 40 per cent. above ordinary rates, exclusive of cost of hutting.

38. *Q.* (*Mr. Muir-Mackenzie*)—That is a much better result than in British territory?—I do not know.

39. *Q.* (*The President*)—Are there any works standing in an unfinished condition?—All but four are finished; two of these have again been taken up as famine work this year.

40. *Q.* You say in your memorandum "no legislation is necessary; what is wanted is funds to complete the works already nearly finished, so as to make them remunerative?"—The works have been constructed on the cheapest possible lines. Money is wanted to put them into really good order and complete the canals.

41. *Q.* In making these tanks were you guided at all by any idea of having a chain of tanks down a catchment basin?—No! Each tank is an isolated work designed simply to provide famine labour at given centres.

42. *Q.* Near their homes?—As near as possible.

43. *Q.* Have any tanks been actually working?—All of them except the four unfinished ones.

44. *Q.* Are they working now?—Some of them are nearly empty owing to the scanty rainfall of 2½ to 3 inches this year.

45. Q. (*Mr. Ibbetson*)—I understand that you are fairly well acquainted with practically the whole of Kathiawar?—Yes.

46. *Q.* Are you well acquainted with Central Kathiawar?—Yes.

47. *Q.* You say that probably the best way of dealing with famine is to create a sort of Insurance fund?—Yes.

48. *Q.* Supposing you are asked, placing that point aside, what are the most effective means of protecting the country against famine, what would you recommend?—Tanks on the hills and weirs across the rivers.

49. Q. The construction of weirs, I understand, would be impossible without some co-operation between the States?—I think so.

50. *Q.* This co-operation is possible, then?—Yes

51. *Q.* By this means you would protect much more than 10 per cent. of the province?—Yes, one-fifth of the Province excluding unculturable land.

52. *Q.* The other four-fifths you cannot protect?—No, much of the land is very bad.

53. *Q.* Why cannot you improve it?—On account of the natural features of the land; there are no possible means of improving it.

54. *Q.* Are wells possible?—I do not think water would be found. There are no gathering grounds for wells.

55. *Q.* You say a great many of these works would pay 5 per cent. interest to Government?—Yes.

56. *Q.* Do you think it would be cheaper to lay out money like that than to spend it on famine relief which brings in no return?—Yes, I think so, because when you have famine works you have to incur extra expenses for hospitals, etc.

57. *Q.* Would it not be still cheaper to make your tanks not by famine labour but by ordinary labour and get your 5 per cent. and save a corresponding amount by the protection afforded?—I think so.

58. *Q.* You think at any rate it would not cost the State much more?—No.

59. *Q* It would be worthwhile having these works as a protection against famine?—Yes. They increase the value and the outturn of crops all round.

60. *Q.* All the works in the statement are nearly finished and are estimated to pay a reasonable percentage and some exceedingly high percentages? That looks as if they are in full working order. Do you think that the average of 5 per cent. would be exceeded?—I think not all round.

61. *Q* When you estimate 5 per cent. what figures do you include?—Simply water revenue.

62. *Q.* You do not include anything for enhancement of the ordinary land revenue?—No; on the other hand we do not take into account loss by lands swamped or taken up by canals.

63. *Q.* Surely an increased yield from the area irrigated would be much more than compensation for that?—Yes.

64. *Q.* Would you say 6½ per cent. inclusive of all sources of aditional income?—Yes, that is a safe estimate.

65. *Q.* Do you include benefit to wells by raising the spring level?—No.

66. *Q.* Taking that into account you get a considerable enhancement?—Yes.

67. *Q.* The profits you show are *net*, after deducting the cost of maintenance?—Yes, they seem high, the reason being that the fields are close to the tanks. In the Deccan the water has to be carried a long way to the fields.

68. *Q.* You say "previous to the famine there were practically no tanks." That means that there had been no survey. Would it not be a good thing to make a special survey to enable the Engineer to say what [illegible] first of all is possible and would be successful and [illegible] think that would be

would be necessary to make some political arrangement with the States. I do not think anything can be done without that.

69. *Q.* Suppose this can be arranged?—Then it would be worth while making a survey.

70. *Q.* I suppose the States have lost enormously during the famine, taking the expenses of relief work and loss of revenue?—Yes.

71. *Q.* Do you think that loss would induce the States to agree to any measure which might protect them in future?—It is, I think, doubtful.

72. *Q.* At any rate you think they would take loans and start works if the money were lent to them at reasonable interest?—I think they would.

73. *Q.* Do you think they are keen about irrigation at present?—I do not think they are.

74. *Q.* You say that about 10 per cent of the cultivable land can be protected by wells so far as protection is possible?—Yes.

75. *Q.* Can you not extend the wells and protect a much larger area?—I think not.

76. *Q.* What is the obstacle?—There is a large area of dry crop lands in the hills and uplands which cannot be protected.

77. *Q.* You say that this year you had a very short rainfall and most of your tanks were empty?—Yes.

78. *Q.* And still you have a substantial amount of irrigation?—At Jasdan they had 3,000 acres this year.

79. *Q.* In years of scanty rainfall, I suppose, the tanks will not fill?—You must have ten or twelve inches of rain to fill the tanks.

80. *Q.* (*Mr. Muir-Mackenzie*)—What is your average rainfall?—About 25 to 27 inches.

81. *Q.* Do I understand you to say that 10 to 12 inches of rainfall would suffice to fill every tank?—Yes.

82. *Q.* (*Mr. Ibbetson*)—With that rainfall you would have full tanks?—Yes; last year we had about 11 inches in one day and the tanks were filled up at once.

83. *Q.* They were filled by a continuous rainfall of 10 to 12 inches?—Yes.

84. *Q.* In your judgment if you get less 10 or 12 inches of rainfall there would be a very considerable chance of failure of crops?—I think so.

85. *Q.* You charge a water rate of 5 to 11 rupees per acre on the Lalpuri tank; do they use all the water?—Yes.

86. *Q.* They have got a sufficient area under cultivation?—Yes, and the situation is favourable as there is a good market within two miles.

87. *Q.* You refer to "small irrigation channels deriving their supply from streams." Are these common?—No.

88. *Q.* You think their number could be increased?—I think it could, very largely.

89. *Q.* (*The President*)—In what proportion?—I cannot say.

90. *Q.* Do you think that much could be done in that way?—Yes.

91. *Q.* Do you think the people would construct the works themselves?—I think they would.

92. *Q.* (*Mr. Ibbetson.*)—You say that "the average rate for water amounts to about Rs. 4-8 to Rs. 5-8 per acre according to the situation and soil." Is there any remission in a famine year?—Yes; we make allowances.

93. *Q.* Supposing it were found possible to increase the supply of water largely, do you think it would be wise to reduce these rates so as to encourage the use of water?—As a matter of commercial enterprise it would not; but from a protective point of view it would.

94. *Q.* Why not as a commercial matter?—There would be extra establishment charges as you increase the area; the dams cost little to maintain, but as the irrigated area increases the establishment charges also increase.

95. *Q.* Putting the commercial aspect aside do you think that by reducing the rates you would encourage the use of water?—Yes, the people would take the water for *juari* and *bajri*.

96. *Q.* They would water *bajri* and *juari* during the rains?—Yes, if the rainfall was short.

97. *Q.* That is when you have got water to spare?—Yes.

98. *Q.* It would not affect your supply for *rabi*?—Practically not.

99. *Q.* Are wells easily exhausted?—Yes, in years of scanty rainfall.

100. *Q.* (*Mr. Muir-Mackenzie*)—They won't work the irrigation wells in ordinary years?—Only to a small extent.

101. *Q.* (*Mr. Ibbetson*)—They could get more from them wells and irrigate a larger area in ordinary years?—Yes.

102. *Q.* Does not the level of the water in wells go down very much in famine years?—Yes, in some wells it went down 10 or 12 feet.

103. *Q.* Do you contemplate the construction of tanks holding a two years' supply?—No. We would lose too much by evaporation.

104. *Q.* You do not advocate them?—No.

105. *Q.* You could make such tanks in some places?—Yes.

106. *Q.* Having got your large tanks holding sufficient storage for two years, would you refuse to give water in one year in order to hold it for next year?—If you mean on the chance of short rainfall next year, I think I would rather take the chance and use up all the water.

107. *Q.* A few big tanks are of very much greater value as irrigation works than a number of small tanks holding the same amount of water?—Yes.

108. *Q.* I see it stated "15,000 wells made by the State in Junaghad for Rs. 200 each pay 50 per cent." If wells can be made to pay profits like that why is not the number very largely increased?—I doubt the figures.

109. *Q.* There is a good deal of uncertainty about sinking wells in Kathiawar?—Yes.

110. *Q.* Can you, as an Engineer, say with any certainty what would be the result of boring for wells?—Not with absolute certainty, but you can form a reliable estimate.

111. *Q.* Do you think that boring would not be worth doing?—I do not think it would.

112. *Q.* Why not?—We tried boring, but for want of skilled labour we did not succeed.

113. *Q.* (*Mr. Muir-Mackenzie*)—We have had all sorts of evidence as to what a well costs. Some are said to cost very little? Those are *kachcha* wells they last a year or two and then tumble in.

114. *Q.* (*Mr. Ibbetson*)—They may last 40 years if you protect them?—Yes, if protected and steined; an ordinary well would cost Rs. 400, a large and deep well Rs. 2,000.

115. *Q.* (*The President*)—Mr. Gopal Das, in his memorandum says that a well 42 to 52 feet deep costs Rs. 200 to Rs. 400?—I doubt the figures; I do not think you can build a well 52 feet deep for Rs. 400. You would have to pay Rs. 1,500 for such a well. I have built several wells and speak from practical experience.

116. *Q.* What would be the diameter of such a well?—30 feet.

117. *Q.* (*Mr. Muir-Mackenzie*)—Is it your experience of some tanks in British territory that people would sooner wait to the very last moment for rain rather than take the trouble of making distributing channels and pay even the light rate which falls on them?—Yes. They should be made to pay a very light rate on all the lands commanded, so that they pay whether they take water or not.

118. *Q.* If on the other hand you put a water rate on the tank and first start by demanding a very low rate do think that would be a good policy?—I think there might be difficulty in raising the rates afterwards. I think that in British territory they raise the rates every five years; it would be very difficult to do so here.

119. *Q.* Why? A man is charged low rates and finds he gets valuable crops, and a profit of say Rs. 20 an acre. If you put on a rupee more to the rate it would be still worth his while to take the profit of Rs. 19?—My experience is that he will say; "for five years I paid so much; why should I now pay more?"

120. *Q.* Would there be no chance of digging small tanks in Bhavnagar where there is black soil?—In Bhavnagar you could. They have also got a few village tanks up in the north-east of Kathiwar.

121. *Q.* Do you consider that the digging of tanks or bunding up would be likely to result in improvement by washing the soil?—I think it would. I proposed this for Runn.

Mr. Mawson.

29 Nov. 01.

122. Q. Do you know anything about water-logged areas?—Nothing.

123. Q. You have no experience of draining?—No.

124. Q. A great number of wells were dug in the famine?—Yes.

125. Q. Is there any chance of these wells being maintained?—Only in the western parts where water is very near the surface.

126. Q. They would be unused in ordinary years?—Yes, they will let them go out of repair even though they have money to repair them.

127. Q. Would it be advisable for the State to advance them money to do that?—Yes.

128. Q. Does the State take Rs. 5-8 an acre on wells?—I think they only take an increased share of the produce; one-fourth instead of one-sixth, that is about the average share.

129. Q. Does the share of produce vary much in different States?—Not very much.

130. Q. Have you ever heard of a system by which the State takes so much per *kos* instead of a fixed assessment?—No.

131. Q. I understand this is done in Bhavnagar?—I do not know that. I have never heard of it.

132. Q. (*Mr. Rajaratna Mdlr.*)—You say famine is almost unknown in this district?—Yes.

133. Q. There is practically no irrigation of recent date?—None, until three years ago.

134. Q. The myat is able to obtain a fairly good out turn from dry crops in normal years?—Yes.

135. Q. Do they consider that it is better to raise dry crops than wet crops which certainly takes a larger expenditure?—I think it is only very recently that they have learnt the benefits of irrigation. Here, near Rajkot, they have good irrigation; every field under command is irrigated and there is great competition to get water.

136. Q. (*Mr. Ibbetson*)—You are talking of irrigation from tanks entirely?—Yes.

137. Q. You say "the area irrigated by wells depends on the size of the wells;" are there different sizes? What is the diameter of an ordinary well?—From 20 feet up to 50 feet.

138. Q.—(*Mr. Rajaratna Mdlr.*)—They irrigate only about five or six acres?—No, about eight acres as a rule.

139. Q. In a well 50 feet in diameter you can have about a dozen *motes* or so?—You ought to have; the people generally use four *motes* in a large well.

140. Q. How deep is a well sunk?—About 30 to 35 feet on an average. You can sink a little *kachcha* well of 30 feet for Rs. 600.

SIXTEENTH DAY.

Ahmadabad, 4th December 1901.

WITNESS No. 29—MR. DAYABHAI NATHABHAI, late Revenue Officer, I'dar State.

Answers to printed questions.

I'DAR STATE.

(MAHI KANTHA AGENCY, GUJARAT.)

Mr. Dayabhai Nathabhai.

4 Dec. 01.

2. Culturable and irrigable areas.—The gross area of the State is 1,000 square miles, of which the cultivable area is 1,200 square miles. Out of this culturable land 100 square miles are protected by wells, about 5 square miles by rivers and tanks, and none by the State or village irrigation works. The characters of the soil are *Goradu* (light yellow soil), *Besur* (mixture of light yellow and black soil) and black soil. The extent of land which is dependent on artificial irrigation alone is 90 square miles. The measurements of rainfall are as follows:—

	Ins.	Cents.
Average rainfall during 5 years (1893 to 1897)	46	57
In the year 1898	22	67
Do. 1899 (famine year)	6	42
Do. 1900	27	95
Do. 1901	22	53

When the rainfall was normal (46·57) there was no demand for water, but from 1898 up to the current year the deficiency of rain has caused a demand for water. The crops which require irrigation are—wheat, maize, barley, "Sarsao," "Methi," "Cheno," "Kang," sugarcane, etc. The crops except sugarcane grown in the plains require 5 waterings and those in the hilly tracts from 8 to 10 waterings. Sugarcane requires from 35 to 40 waterings. Wheat, "Methi," "Sarsao," and barley require waterings from November to February; maize from October to December; Cheno and Kang from March to May. Sugarcane requires waterings for the whole year excepting the monsoons. As there is no State irrigation work, the distribution is not controlled. The lands irrigated by wells are watered by turns in proportion to the area occupied by the tenants and in proportion to the shares borne by them in the expenses of constructing wells. Where revenue is collected in kind the State charges are from one-eighth to one-fifth of the produce in kind which includes irrigation revenue. Where the Survey Settlement Rules are applied separate irrigation charges over and above the land revenue are levied per kos on the area of land attached to and commanded by a well, taking into consideration the following points:—

(1) The supply of water in the well.
(2) The depth of the well.
(3) The quality of water, whether sweet or brackish.

3. Black cotton soil.—The greater portion of black cotton soil remains uncultivated. It looks dreary owing to the absence of trees. That portion of the land which is well drained is generally cultivated and proves fertile and that which is deficiently drained is water-logged and is cracked into fissures when it dries up; consequently ploughing becomes impossible is such a land. The system of proper drainage in making the black soil cultivable and yielding bumper harvests is essentially good, which is evident from the fact that the black soils on both sides of the Bombay, Baroda and Central India Railway line have become more fertile by the side ditches which have facilitated their drainage. There is no demand for water in the black soil when the rainfall is sufficient, but the demand is felt only when there is drought. Excessive as well as deficient rain causes decrease in harvest in such soils. There is no desire for irrigation works on the part of the owners of black soils, and the construction of tanks for such soil is not considered as remunerative or as important as for other classes of soils.

7. Wells.—The total area irrigated by wells in ordinary years is 90 square miles, and in years of drought it is 60 square miles. The smallness of the area irrigated by wells is due to the fact that the wells in this part are fed rather by percolation than by springs. The number of annual average construction of new wells during the last 10 years is 80 *pakka* wells and 200 *kachcha* wells. The concession given to the constructors of new permanent wells in Khalsa villages of Vighoti system is 10 years' exemption from the levying of water-rates and in villages of Vaje (in kind) system is remission of a part of revenue in kind for 10 years. Also advances are given to encourage the construction of new wells. If more liberal concessions than those mentioned above be given, it will stimulate the desire of constructing a greater number of new wells. There is a decrease of water in wells by half the part on account of droughts of 1899—1901. The wells which ran dry were deepened, but the endeavours failed with regard to the wells in the hilly tracts, whereas with regard to those in plains were fairly successful. During the famine year nearly three-fourths of the number of wells were abandoned. The average depths of wells below surface are as follows:—

Name of putta.	Average depth in feet.
Meghraj	30 to 60
Ahmednagar	30 to 50
Mahial	20 to 40
Sabalpur and Bayad	20 to 30
Oda	20 to 25
Isri, I'dar, Jadar and Wadali	15 to 25
Sabli and Choriwad	15 to 20
Khed and Bhiloda	12 to 20

The cost of one *pakka* well varies from Rs. 100 to Rs. 600. The area served by one well varies from 3 to 18 acres.

8. *Drainage works.*—The parts in which lands or crops are injured by water-logging or excess of water in very wet years are Bayad and Ahmednagar puttas.

Mr. Dayabhai Nathabhai.

4 Dec. 01.

1. Q. (*The President.*)—Is there a decrease of population in the State?—Yes, during the famine nearly 43 per cent. died and emigrated.

2. Q. What is the population of the State now?—168,000.

3. Q. Are any measures being taken to drain black cotton soil?—No; much land is uncultivated owing to its being water-logged. Some cultivators have made a drain round their fields and these yield better crops.

4. Q. Wells don't seem very satisfactory, you say several were given up at the time of famine?—Yes.

5. Q. Are the people still sinking wells?—Some are; there is a rock substratum.

6. Q. What measures are you taking to make the State better fitted to withstand another famine?—Sinking wells and making tanks.

7. Q. Who is doing that?—Both the people and the State. The Darbar gives advances.

8. Q. There are not many tanks, are there?—Yes, there are a good many, but they are not in good repair.

9. Q. Are they going to repair those that exist?—Yes.

10. Q. Does your Darbar give advances for making wells?—Yes.

11. Q. How much assessment do you remit for those who build wells?—For *pakka* wells ten years' assessment is remitted and for reclaiming the old wells five years.

12. Q. Have you a Bhil population in your State?—Yes.

13. Q. Do they cultivate?—Yes.

14. Q. (*Mr. Rajaratna Mdlr.*).—Would it not pay the State to construct drains in water-logged areas?—Yes, that is my opinion.

15. Q. Is the State doing anything in that direction?—No.

16. Q. (*Mr. Muir-Mackenzie*).—Does the Darbar ever give money to the cultivator for the construction of wells?—Yes.

17. Q. Does the cultivator repay the loan or is he charged assessment instead?—He repays the loan, but the custom here is that the Darbar pays for the materials and the people give the labour. In this case he is charged the assessment.

18. Q. At the end of the ten years' assessment what does the Darbar charge?—Rs. 3 to Rs. 4 per acre. In *pakka* wells they charge Rs. 7 to 17 per *kos*. The dry assessment is Rs. 1-8 to Rs. 2-8 per acre.

19. Q. Then the State charges double the usual assessment?—Yes, but the wet assessment for *kachcha* wells is only charged in a year when the well is used.

WITNESS No. 30—MR. HARJIVAN GOKALDAS, State Engineer, I'dar.

Answers to printed questions.

I'DAR STATE.

(MAHI KANTHA, GUJARAT.)

With reference to paragraph 3 in the memorandum of points, I state the following as far as my experience goes. There is no objection as to the capability of small tanks to hold water if they are constructed in black soil. High earthen dams without masonry core-walls to hold 30 to 40 feet of water at the deepest, if properly constructed, can be made of black soil with casings of some hard materials. If only black soil is used for dam work, there is fear of cracking it and the exposed surface is washed out to some extent. With reference to paragraph 8, I want to say that the river Varoni near the village of Bayad of this district, in flood of ordinary rain, rises above its banks, and culturable land in its vicinity is flooded and it causes a great loss to crops as well as to land. Also water lodges for a few days near Bayad and keeps the surrounding land damp for some time; so an extra drainage is required both on sanitary and agricultural grounds. The work will be provided from the funds by the State. There had been several applications from time to time by the village people to the authorities to relieve them from the difficulties mentioned above; so a channel was cut for an extra drainage in order to free the people from the sufferings. The aimed object is not realized as the work is left uncompleted, and therefore it is considered desirable to finish the work with improvements to the existing one. It will prevent loss of revenue as well as damage to land, and people will thus be freed from the sufferings. With reference to paragraph 9 I show the classification of the works on which relief labour was employed in this district during the last famine, together with the amount expended on each class as under:—

Class.	Amount. Rs.	A.	P.
Deepening of old small village tanks—22	74,782	4	10
Water storage works, *i.e.*, kunds—6	7,284	13	8
Roads—15	48,016	10	4
Collection of metal	24,216	5	0
Miscellaneous, *i.e.*, tools and plants establishment, etc.	8,118	11	4
TOTAL	1,62,398	13	2

Mr. H. Gokaldas.

4 Dec. 01.

The stuff thus excavated by deepening those tanks was thrown on banks. The catchment area of all the above tanks being very small about a mile, these tanks are only filled in the year of good rainfall, *i.e.*, 40 to 50 inches, which served the purpose of watering cattle and feeding adjoining wells. This year the average rainfall in this district is 22·53 inches. The tanks are not filled and most of them are already dry. I do not think it advisable to spend any more money on them as they are not useful, neither in the year of drought nor for irrigation. As for roads, although they are incomplete I do not think it necessary to spend anything more at present as they are only village roads. With reference to paragraph 10 to open relief work in this district, I have prepared programmes as follows, except those of the works to be opened in northern division of this district, the detailed survey of which is under preparation:—

(1) A village tank at Raighud for village supply and irrigation. The work will provide for 1,000 labourers for six months.

(2) A village tank at Meghraj for village supply and irrigation. It will also provide for 1,000 coolies for six months.

(3) An irrigation tank at Isri (Punjapur) for irrigation. It will provide for 3,000 labourers for six months.

(4) An extra drainage work at Bayad for preventing loss of revenue and damage to land, etc. It will provide for 1,500 labourers for six months.

(5) Six miles channel at I'dar for feeding old existing tanks during monsoon from adjoining nullahs for city supply and irrigation. It will supply 1,500 labourers with work for five months.

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1. Q. (*The President.*)—With reference to what you say about earthen dams, have you ever made any such dams?—Yes, in Kathiawar.

2. Q. Were you employed on tank works?—No, I was Head Surveyor; in addition to which, I had to supervise the works of Rajkot and Jasdan tanks for some length of time.

3. Q. Is much land uncultivated in your district?—Yes, I'dar is thinly populated; one-third is in hilly country and uncultivated.

4. Q. You say in your note that this year the rainfall was 22½ inches, that is a very small rainfall?—Yes, it did not fill the tanks. In my opinion tanks are not good for irrigation.

5. Q. Are they of any use for anything else?—Yes, in ordinary years they are useful for drinking purposes.

6. Q. Do they grow rice under them?—I cannot say.

7. Q. How long have you been in the State?—Four months.

NINETEENTH DAY.

Surat, 10th December 1901.

WITNESS No. 31—RAO BAHADUR MADHAVRAM HARINARAYAN, Dewan, Cambay State.

Answers to printed questions.

I.

Mr. Madhavram Hari-narayan.

10 Dec. 01.

My statement relates to the condition in the Cambay State alone. I can give opinion about the points III—Black Cotton Soil; VII—Wells and Tanks; VIII—Drainage Works.

General condition.

2. Before proceeding to give opinions about these matters I think it is necessary to explain the nature of the soil, the existing condition and the irrigational requirements of the Cambay State. The three well-known soils of Gujarát, (1) Black, (2) Gorad or red, and (3) Besur or brown, are found in Cambay. The eastern villages have red and brown soil, while black soil preponderates in the western villages. The first block is well-wooded, but the second is barren of trees. Sweet water is found in about half the area of the eastern block. But in the other half of the eastern villages and in the whole of the black soil villages the water is brackish and quite unfit for irrigation. In the sweet water villages a large area is irrigated from wells, but in the rest of the district well-irrigation is impossible. The principal crops grown in this part of the State are rice, wheat and cotton. The rainfall is uncertain and variable and therefore irrigation is necessary when rainfall is scanty or unseasonable. But the only possible means of irrigation in the western villages is a canal from the Sábarmati River.

Cultivable area.

3. The area of the Cambay State is 202,167 acres, of which 148,180 acres are cultivable. The cultivation is mainly dependent on the rainfall which amounts to 35 inches on an average every year. There is no demand for water during the monsoon if the rainfall is sufficient and seasonable. But the rainfall is always uncertain and variable, and therefore rice and other dry crops require water during the monsoon when there is a long break. Monsoon generally fails in the months of September and October and then water is needed for rice, kodra and bájri. Two or three waterings at the end of ten days each are quite sufficient for them.

BLACK COTTON SOIL.

4. The area of black cotton soil in the Cambay State is 36 per cent. of the total area.

5. All tanks constructed in black soil hold water for the whole year if the rainfall is sufficient. Earthen dams in black soil can be made 12 feet high without masonry core walls.

6. Rice and wheat are the two crops which require irrigation in black soil. Rice is grown in the monsoon and wheat is a rabi or winter crop. There is no demand for water for these crops when the rainfall is sufficient and seasonable. Rice requires water in case of prolonged drought and when the rainfall is not ample. Wheat is sown in October and November if the rainfall is sufficient in September and October. If there is no rain in these last two months wheat cannot be grown without irrigation. If the rainfall is not ample, farmers grow cotton instead of wheat in black soil. Black soil is generally not irrigated in years of good rainfall, when rice and wheat can be grown without the assistance of irrigation.

7. The owners of black soil do not openly express any desire for irrigation works, because they are accustomed to rest satisfied with their *nasib*. They know that water underneath their land is brackish and cannot be used for irrigation. They have no idea about river canals. Tanks cannot always be depended upon for irrigating wheat which may require water in December and January. Small rain-fed tanks are not considered very useful or important for this purpose. They can supply water to a small area of rice land in the monsoon. Canal is the only means of irrigating a large area of wheat cultivation in black soil.

8. In black soil only one crop is raised, either wheat or cotton. No second crop is grown after removing wheat. But if irrigation is possible it can increase the yield. The produce per acre of unirrigated wheat is about 15 maunds, but irrigation can produce double the quantity.

II.

IRRIGATION—GENERAL.

9. There is no obstacle to the extension of irrigation from sparsity of population, insufficient supply of cattle, insufficient supply of manure, unsuitability of soil, or uncertainty of the supply of water, or want of capital for initial expenditure, or fear of enhanced rent or assessment, or uncertainty of tenure, or other reasons. For good cultivation two things are necessary—water and manure. Supply sufficient water or provide irrigation works and the cultivators are sure to take advantage of them. If they get sufficient water, they will get all other means and try to remove all the obstacles to the extension of irrigation.

10. In the Cambay State land irrigated from works constructed by private capital by a landlord or tenant is exempted from enhancement of assessment on account of irrigation. The exemption is secured simply by a notification and it is considered quite sufficient here.

11. Where irrigation is possible cultivators can freely take loans from Government for irrigation purposes if certain inconveniences are removed. The applications for loans must be promptly disposed of and there should be no unnecessary delay and applicants should not be required to go often to the Revenue office for the purpose of the loans. If the rate of interest is reduced to 4 per cent., it will be a great boon to poor cultivators. It is not necessary to give remission of interest or the advance unless the attempts to obtain water have failed. But the most important thing is to extend the period of repayment, and when instalments are not punctually paid for good reasons measures should not at once be taken to recover the amount by distress and sale of the defaulter's property, but suspensions may be given from time to time, as is done by *sowkars*.

12. There is no fear of irrigation injuring the remaining cultivation by attracting cultivators to the irrigated tracts.

TANKS.

13. In the villages of the Cambay State all the tanks are rain-fed. There is no other way to supply them with water.

14. Small tanks are under the control of the village people who distributed water according to their own convenience. Cultivators make small channels or drains to take water to their fields. But big tanks are managed by the Vahivatdár under whose orders the distribution of water is regulated.

15. These tanks are useful in supplying water to rice lands alone. If the rainfall is ample and seasonable no water is required for rice. It can be utilized for irrigating wheat or barley and two or three waterings can empty the tank in December and January. But in a year of scanty rainfall or of drought tanks are hardly full and all the water is utilized on rice fields in September or October.

16. A village tank of ordinary dimensions can irrigate from 50 to 100 acres of land.

17. There is not the least doubt that irrigation from tanks can increase the produce of land. If they supply water to withering rice crops in the year of scanty rainfall, the crop is saved, and it is a gain of at least Rs. 35 per acre. If wheat is irrigated the yield is double. It is hardly possible to cultivate two harvests with tank water because the supply is not certain and sufficient. But more valuable crops can be grown by irrigation from tanks. Owners of fields situated close to tanks often grow tobacco of the value of Rs. 100 per acre, instead of bájri, giving Rs. 25 per acre. Of course in a year of ample rainfall rice does not require water from tanks, which can however supply water to wheat crops. The value of the tanks is nothing in the year of scanty rainfall or of drought when they are not filled up with water and the supply ceases too early. But if the supply is too late, *i.e.*, in the month of October, the value of irrigation is not diminished because tank water is generally useful in October.

18. Irrigation from tanks is not supplemented by irrigation from wells.

19. There is no canal or tank owned by a private person in this State. If land is irrigated from a Government work one rupee is charged per acre as the irrigation cess. No irrigation cess is paid if water is taken from a work constructed by private capital. The cess is paid on the area actually irrigated. Darbar recover it from the landlord who may charge it to his tenants.

20. All the expenditure necessary to bring the water to the field is incurred by the cultivator who digs the channel which does not cost much.

21. All the tanks are repaired by the Darbar.

22 No private persons would like to construct tanks and therefore they should be constructed by the State, where necessary.

23. Tanks are generally liable to silt, but no inconvenience is felt on that account. Silt clearance is not necessary every year. It is sufficient if tanks are deepened at the interval of eight or ten years.

Wells.

24. Wells are to be found only in about 20 eastern villages where there is sweet water.

25. The average depth of permanent wells is about 40 feet. The supply is from springs and is not liable to fail or does not become too saline to use in an ordinary year. In a year of drought the supply does not altogether fail, but is decreased. The wells are then deepened.

26. The average cost of construction of an ordinary well is about Rs. 400. If proper care is taken, the wells last for about 100 years.

27. The water is raised by koss or leather buckets. One *kos* can irrigate about three acres of land only. There are wells on which from one to eight *kos* can work at the same time. By well water two crops can be raised after the monsoon crop is removed—one in winter and the other in summer—so that six acres can be irrigated in a year by one *kos*.

28. Irrigation from wells is very important. It much increases the value of the produce of land. Well water is generally used in raising second or winter crops and also third or summer crops. After removing the monsoon crop of khári, valued at about Rs. 25 per acre, wheat or barley is sown in November. The yield of these crops is valued at about Rs. 40 or Rs. 50 per acre. The winter crop is removed in March and then *júár*, *káng* or *chino* is sown, which gives about Rs. 20 per acre.

29. Another way of utilizing well water is to raise more valuable crops of tobacco, vegetables and market-gardening. But only one such valuable crop is raised during a year valued at about Rs. 100 per acre.

30. Well water is not used in increasing the yield, except in a year of drought, when withering monsoon crops or bájri or kodra are irrigated.

31. The above good results of irrigation are for years of ample rainfall. When the rainfall is scanty the yield is reduced to half the value. Even in the famine year two crops were raised after the monsoon by well water, but the yield was small.

32. Cultivators have nothing to pay to the Darbar on account of irrigation if water is taken from wells constructed by private capital, as the land assessment includes assessment of sub-soil water. The survey settlement has been made by British officers on British principles and therefore the sub-soil water has been charged whether used or not. If the irrigation is from wells constructed at the expense of the Darbar, one rupee is charged on account of irrigation cess per acre of the area actually irrigated during the year.

33. The owners of wells sometimes supply *kos* and manure to their tenants for the purpose of irrigation and receive one-third to half the share of the produce as rent. Some landlords charge Rs. 5 to Rs. 7 per acre of the irrigated area over and above the dry crop rate and do not supply manure or *kos*.

34. No serious difficulty is encountered in the construction of wells in this State as the sub-soil is sandy. If there is too much sand, wooden curbs are used on which the masonry work is done.

35. The Darbar keeps in stock boring tools which are lent on small hire to those who want to deepen their wells. No other assistance from the State is given. It is a good thing to supply boring tools which sometimes are very useful in increasing the supply of water. In some cases these tools are found to be unsuccessful.

Mr. Madhavram Harinarayan.

10 Dec. 01.

36. Cambay Darbar gives takávi to cultivators for sinking wells and also constructs *sarkari* wells at its own expense. It is necessary that in villages where sweet water is found every field should have a well for irrigation. If the occupant is a *Kunbi* or an intelligent and hard-working man, he likes to make his own well and applies for takávi which is freely given to such cultivators. But if he is an idle or poor *Koli* he does not like to undergo the trouble of sinking a well. In such cases *sarkari* wells are sunk at the expense of the State and the occupants are induced to use water and raise irrigated crops and are supplied with the necessary means. I do not see any objection in the construction of wells by Government in private property. If the owner is willing to make his own well and wants takávi for that purpose, it should be given. If he is willing to have a well but unable to undergo the trouble, the Government, Public Works Department, should construct the well for him. Anyhow the number of wells must be increased where there is good water and every field must be provided with a well.

37. Temporary wells are not made in this State. As the bed is sandy no such wells can be made here.

38. The total area irrigated by wells in ordinary years in this State is about 2,500 acres and in years of drought is 7,000 acres. In the last ten years 128 wells were constructed—85 by the State and 43 by the occupants—with the assistance of takávi. It is certainly very desirable to stimulate the construction of new wells by inducements. If grant-in-aid is given from the Famine Fund by Government, a number of wells can easily be constructed which will give great protection against famine.

39. During the drought of 1899—1901 almost all the wells were affected. The supply of water was decreased. Attempts were made to deepen the wells. Success was attained in some cases and in others the trouble and cost were simply thrown away.

40. The average depth of water in wells is 8 to 10 feet.

41. Irrigation tanks should be constructed by the State and wells are constructed either by the Darbar or the occupants of land. But an irrigation canal from the Sábarmati River is necessary for black soil villages. This work cannot be done by the Cambay State alone. The assistance of the British Government is necessary in this respect. There is an old channel known by the name of Alang. It is about 22 miles in length from the village of Asamali situated on the Sábarmati River in the Mátar Táluka of the Kaira District to the town of Cambay. It passes through British and Cambay villages. The portion lying within Cambay limits is kept in good repair. It is used as a drainage channel and also supplies water to rice fields along its course. If it can be made to carry Sábarmati water for irrigation purposes, it will be a great boon to cultivators. It can be a very important irrigation work in this part of the country. It is necessary that British officers should take up this question.

Drainage Works.

42. The western part of the Cambay State is an open flat plain with a slight inclination towards the sea. The storm-water of a portion of the Kaira District which finds an outlet to the sea through the Cambay Territory flooded some of the Cambay villages and did much damage. But the Darbar has spent a lot of money in improving the drainage of the district. The Alang Canal has been repaired within Cambay limits, but it is in a bad condition within the British district. Three other new drainage channels have been cut to give an easy outlet to storm-waters and the old village channels have been repaired. The drainage in the district has thus been much improved. A large area which remained flooded during the rains has been rendered fit for cultivation. No more drainage works are now necessary in this district.

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1. *Q.* (*The President.*)—You are Dewan of Cambay?—Yes.

2. *Q.* How long have you been in that place?—For the last eleven years; I was the Chief Revenue Officer for four years.

3. *Q.* You were there all through the famine?—Yes.

4. *Q.* I suppose Cambay is not a place that suffered much before the recent famine?—Not within recent memory.

5. *Q.* Did it suffer much during the last famine?—Yes; there was a heavy mortality and a great loss of cattle.

6. *Q.* You had two important pieces of work, 12½ miles of railway and the Daloli tank?—Yes.

7. *Q.* What is the storage capacity of that tank?—It is about two miles in length.

8. *Q.* How many acres could it irrigate?—About 400 acres.

Mr. Madhavram Hari-narayan.

10 Dec. 01.

9. *Q.* Is it finished? Yes, it supplied water to rice this year. The rice elsewhere was a failure.

10. *Q.* Over 35 per cent. of the area is black cotton soil?—Yes, the rest is *gorat* and *besar*.

11. *Q.* You have not got well irrigation to a large extent?—We found good sweet water in only about 20 villages, and there we have wells.

12. *Q.* (*Mr. Muir-Mackenzie.*)—Has your State been surveyed?—Yes.

13. *Q.* Under the Survey Settlement?—Yes.

14. *Q.* (*The President.*)—Water lies very deep; about 40 feet?—Yes.

15. *Q.* You say, "where irrigation is possible, cultivators can freely take loans from the Darbar for irrigation purposes." Do you mean they could get advances from the Cambay Darbar for tanks or merely for seeds?—For everything; for tanks, for purchasing bullocks, for seeds and for grain.

16. *Q.* What are the chief irrigation resources?—Wells.

17. *Q.* You must be rather uneasy about these wells?—We gave advances for wells mostly in 20 villages. In the other villages the water is brackish and no one asked for takavi.

18. *Q.* How much interest does the State charge just now?—We follow the British policy.

19. *Q.* Of 5 per cent.?—No, we charge 6 per cent.

20. *Q.* You say, "tanks cannot always be depended upon." Why is that?—They are too small and soon get exhausted.

21. *Q.* Talking about these tanks, Mr. Mollison said that the people should distribute the water among themselves. What do you think of that?—It must be placed under the supervision of a Revenue Officer to distribute water to two or more villages.

22. *Q.* How do you maintain your tanks?—They are repaired at the expense of the State when it is considered necessary.

23. *Q.* Does the State send officers to look after the repairs?—Yes, that is under State supervision.

24. *Q.* Do you think that the number of tanks are capable of being enlarged very much?—In the Cambay State there are only four or five tanks which could be made to hold a large quantity of water. They can be fed from nallahs; we propose to enlarge 3 or 4 tanks.

25. *Q.* Your country is very flat?—Yes.

26. *Q.* You say that the Cambay Darbar not only gives takavi to the cultivators to make wells, but also makes wells at its own expense?—Yes, in the famine year we sank about 100 wells.

27. *Q. Kachcha* wells?—Yes, we are building these wells *pakka* now. Last year we built ten masonry wells, this year we are also building ten.

28. *Q.* How do these wells pay; do they pay a certain water rate?—We charge only one rupee per acre.

29. *Q.* (*Mr. Ibbetson.*)—On a *pakka* well?—Yes.

30. *Q.* (*The President.*)—You cultivate 2,500 acres by well irrigation?—Yes.

31. *Q.* During the last ten years 110 wells were constructed?—Yes.

32. *Q.* Your present charge for *takavi* is 6 per cent. Would it make much difference if you reduced it to 4 per cent.?—It would be a relief to the poorer people.

33. *Q.* Do you think it would be a good policy to say to these people who have suffered from famine "if you make *pakka* wells within two or three years, you shall have to pay no interest." You merely pay the instalments?—I do not see any harm in that.

34. *Q.* There is another method proposed, namely, to give takavi without asking for the money back and assess a water rate for the future; would that be possible, and would it pay eventually?—I think that would be more convenient; the cultivators would like that.

35. *Q.* You see no objection to that being done?—No, I see no objection.

36. *Q.* You say the Darbar keeps in stock boring tools which are lent on small hire to those who want to deepen their wells?—Yes; in the famine year we deepened about two dozen of them.

37. *Q.* What is the average depth to water?—40 feet.

38. *Q.* You say that a good deal has been done in the way of drainage?—Yes.

39. *Q.* Do people take objection to drainage?—Not at all; they see the advantages of it.

40. *Q.* They have found that land which was water-logged has improved by drainage?—Yes; land has been reclaimed on a large scale and has become culturable and has been taken up by cultivators.

41. *Q.* Was it flooded by the sea?—No.

42. *Q.* You say in your paragraph 41, "an irrigation canal from the Sabarmati river is necessary for black soil villages"?—Yes, to supply water to rice and wheat and not to other crops.

43. *Q.* Do you think that may be done from Government wells?—Not if there is a canal.

44. *Q.* Mr. Mollison says that mischief may be done by a canal?—I don't think so.

45. *Q.* Do you know how much rainfall there is in your State?—About 35 inches.

46. *Q.* (*Mr. Higham.*)—You are on the left bank of the Sabarmati river?—Yes.

47. *Q.* Do you propose to get irrigation direct from the Sabarmati or to have a canal taken from the Sabarmati?—A canal.

48. *Q.* This is you say a black soil district?—Yes, nearly all black soil.

49. *Q.* Is canal water any use in black cotton soil?—It is good for rice.

50. *Q.* When the soil gets water-logged, what will you do?—Drains must be made; we have made drains.

51. *Q.* Supposing we were to make a canal from the Sabarmati to irrigate in the Cambay State, would your State pay for it?—We would contribute our share.

52. *Q.* Has it been proposed?—Correspondence has been going on with the Political Agent.

53. *Q.* Has any settlement been arrived at?—No.

54. *Q.* Have you heard any complaints against the drains?—No; we have provided them with regulators and sluices; we utilize them as irrigation channels also; we have impounded rain water and given it to rice.

55. *Q.* Has the State made the regulators?—Yes.

56. *Q.* In dry years do you hold up much water?—Yes, if there is sufficient rain.

57. *Q.* If there is not much rain?—We cannot get any water.

58. *Q.* When there is a great deal of rain you open the regulators?—Yes.

59. *Q.* How many regulators have you got?—Four big ones.

60. *Q.* What is the length of the drains?—There are three drains which are ten miles in length.

61. *Q.* It is no use making wells in this part?—No, there is no sweet water; the water is too brackish.

62. *Q.* Tanks?—In every village we have tanks.

63. *Q.* Do they run dry?—Yes.

64. *Q.* Under these tanks you have got wells?—Yes; there are wells for drinking purposes situated under the tanks. They are in the beds of tanks and in no other places.

65. *Q.* Are they sweet wells?—Yes.

66. *Q.* You don't make any other wells because they are brackish?—Yes.

67. *Q.* (*Mr. Ibbetson.*)—Do you take revenue in kind?—No; in cash, it is a regular survey settlement.

68. *Q.* How much does it cost to make a well?—Rs. 400; we can make a well for Rs. 200, also with burnt rings and earth.

69. *Q.* What is the cost of a *pakka* well?—Rs. 400.

70. *Q.* How many acres will it irrigate?—Three acres.

71. *Q.* For which you charge Re. 1 per acre or Rs. 3 in all; that does not pay the State?—We do not take a commercial view of it; we want to profit the people.

72. *Q.* How many wells did you make during the famine?—100 *kachcha* wells.

73. *Q.* Do you still make wells?—Yes, ten wells every year.

74. *Q.* Since when?—Since the famine. It opened our eyes.

75. *Q.* Since the last two years?—Yes.

76. Q. Do you intend to go on?—We do.

77. Q. (*Mr. Muir-Mackenzie.*)—Would a canal in your black soil be of any use for wheat?—Yes. Tank water is not sufficient for irrigating wheat at present.

78. Q. Would it be useful for wheat if you have sufficient water?—Yes, I think so.

79. Q. Mr. Mollison suggests that in black soil it would be only useful for rice?—Yes, and also for wheat.

80. Q. What is your black soil; is it very deep; is it like the Broach black soil?—It resembles the light black soils of Ahmadabad.

81. Q. What do they irrigate?—In some of the villages situated on the Sabarmati they make *kacheha* wells and irrigate wheat, barley and chino; the yield then is double.

82. Q. Do they irrigate rice from *kacheha* wells?—No, only wheat.

83. Q. You say you would like to extend the period of takavi instalments?—Yes.

84. Q. To how many instalments?—We leave it to the convenience of the cultivator, we have not fixed a period, we fix the period at the time of giving it; if he fails, we do not take measures to recover by the sale of his property; we give suspension.

85. Q. What period do you allow?—Six years. We ask the cultivator in what time he will be able repay it.

86. Q. I suppose he generally wants a longer period than six years. Do you allow such a long period as 20 years?—We have never given that period up to this.

87. Q. What is the longest period for which you have given it in your experience?—I think not more than six years. *Mr. Madhavram Hari-narayan.* 10 Dec. 01.

88. Q. At what rate of interest do the cultivators borrow from the banias?—At 9 per cent. and 12 per cent.

89. Q. Never higher than that?—No; we have made a rule that we will not allow interest at more than 12 per cent.

90. Q. Can a cultivator sell his land in the Cambay State?—Yes; he can.

91. Q. Without the sanction of the State?—Yes.

92. Q. What is the average assessment on dry crop lands in the Cambay State?—Rs. 2-8 to 6 for first class land.

93. Q. Wells are sunk at the expense of the State?—Yes.

94. Q. The State makes a well from beginning to end?—Yes; the work is done under State supervision.

95. Q. Not done by the cultivator?—No.

96. Q. Does he not supply any labour?—The labour is paid for by the State.

97. Q. The cultivator does not supply his own labour and that of his family?—Everything is done by the State; and everything is done at the expense of the State.

98. Q. You say the Courts do not allow more than 12 per cent. interest?—No, they do not.

99. Q. That does not prevent merchants from charging more?—Certainly not.

TWENTY-THIRD DAY.

Poona, 19th December 1901.

WITNESS No. 32.—MR. D. A. VICHARE, L.C.E., EXECUTIVE ENGINEER, KOLHAPUR STATE. *Mr. D. A. Vichare,* 19 Dec. 01.

Answers to printed questions.

A.—GENERAL.

The answers given below refer to the Kolhápur State proper together with the feudatory Estates except the Vishálgad and Ichalkaranji, as no information has been yet received from them. As I was in charge of the Public Works Department as an Executive Engineer and was entirely entrusted with the management of the famine works during the last three occasions, namely, in the years 1896-97, 1899-1900 and 1900-1901, I have also to manage and supervise the irrigation tanks in the District. I have thus made myself acquainted with the District and with the nature of irrigation works that are well suited for this District.

2. The average rainfall in each of the talukas into which the State is divided is given below in the table:—

No.	Name of Taluka.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.
1	Karvir . .	0 48	...	0 23	1 28	2 0	6 7	9 72	8 85	3 66	2 93	...	...	35 31
2	Panhála . .	...	...	...	...	...	...	...	...	...	...	...	...	...
3	Bhudhargad .	...	...	...	...	...	...	...	...	...	...	...	..	...
4	Gad Hinglaj .	0 9	0 6	0 71	2 40	0 62	9 43	7 65	6 37	2 45	1 86	0 37	...	32 1
5	Shirol . .	0 27	...	0 92	1 58	2 47	2 62	2 54	2 98	4 41	2 18	0 4	...	20 1
6	Alta . .	0 12	0 4	0 65	2 27	1 88	4 28	4 82	5 65	3 73	2 44	...	...	25 58
7	Rádhág . .	0 2	...	0 60	2 26	2 22	3 73	1 95	1 48	4 64	4 18	0 31	...	21 39
8	Katkol . .	0 17	...	0 22	3 13	3 58	2 33	1 26	1 45	4 64	2 29	...	...	19 7

3. There is no obstacle to the extension of irrigation arising from any of the causes mentioned in this question under clauses 1 to 6.

4. The question 4 is not applicable to this District as no private capital has been expended on constructing irrigation works.

5. Loans are not so freely taken by the people under the Land Improvement Act as one would expect. It is a fact that people do expect and are anxious to receive loans from Government provided they would receive the the fullest amount in time of need, when they could utilize the same in a most advantageous and economical way and with the least possible troubles which they are obliged to undergo before they actually receive the sums through the Revenue authorities, and village patils and kulkarnis.

(1), (2) As regards reduction, we will neither recommend any reduction in the rate of interest, nor in the remission of the interest since the loans are advanced in this State at a sufficiently low rate, being 6 per cent. per annum.

(3), (4) We will also not recommend partial remission of the advance as well as total remission in case of failure of the attempt to obtain water, for the simple reason that the wells dug by the people, even if no spring is tapped, get filled up by rain water and retain the same for some months. Cultivators make use of such water for their ordinary winter crops.

(5), (6) We will recommend the extension of the period of repayment which is at present Rs. 100 per year. We do not wish to recommend grants-in-aid. I mean by this that the Government are to pay a certain percentage of the

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cost incurred by the cultivator, but practically this will be impossible to determine as we cannot rely upon the data given by the cultivators, and in addition to that Government will be put to very heavy expenses which the present finances of the States would not permit.

6. The extension of irrigation does not tend to injure the remaining cultivation by attracting its cultivators to the irrigated tracts, as the people find ample work near their villages and they are thus reluctant to leave their houses. There is a strong desire evinced among the people of this District to have means of irrigation extended and increased. We can quote here a few examples of tanks recently added to our District, *viz.*, Aligin in Alta and Sarud in Panhála Peta. The questions B and C in connection with the canals of continuous and intermittent flow are not applicable to this District as there are no canals on this side yet constructed.

D—Tanks.

23. (1) The tanks in this District are supplied by rain water.

(2) Water is distributed to the fields by means of water-courses or channels excavated along the contour lines

(3) (*a*), (*b*), (*c*) Tanks in this District could be classified into two divisions according to their location. Those in the Talukas of Karwir, Panhála and Alta get ample supply every year, and unless there will be successive famines for two or three years, the supply is generally maintained throughout the years to the full extent during the first year, partially during the second and *nil* in the third year. Such is not the case for tanks in the Shirol Ráibág and Katkol Talukas. Otherwise the supply runs for twelve months in the year of ample rainfall, and for about four to eight months in a year of scanty rainfall, and *nil* in a year of drought.

24. (1) The people do not wish to have two harvests instead of one by the aid of irrigation, as they find it more profitable to substitute valuable crops of varieties. For example, if a cultivator has 10 acres of land he prefers to sow 5 acres with sugarcane and 5 with three or six months' crops and to keep the latter tilled and unused for the remaining months. Alternative process is repeated next year. In the latter case the value of the crop is increased by about 4½ times. For example, if 6 acres of land unaided by irrigation can yield 3 khandis of rice or other autumn crop worth about Rs. 180, it can yield with the aid of irrigation 1½ khandis ordinary crop of rice, etc., worth Rs. 90 from 3 acres and 15 khandis jaggery from the remaining 3 acres worth Rs. 750, that is, a total of Rs. 810, that is nearly 4½ times. In fact, the irrigation can increase the value of crop by increasing the yield about 7½ times in the case of ample rainfall, but in the case of scanty rainfall they can at the most get double the winter crop, or, in other words, the irrigation can increase the value of crop about two times and *nil* in the year of drought.

25. The question is replied to above.

26. The irrigation is not ordinarily supplemented by irrigation from wells in this District.

27. (1) The increase in the total value of the produce per acre due to the irrigation on the average of a normal term of years can be from Rs. 30 to Rs. 140, but in the year of scanty rainfall or drought the same will be from Rs. 30 to Rs. 60.

28. The average annual rate per acre paid on account of irrigation—

(1) By the cultivator of the land to the owner of the tank in the form of water-rate is Rs. 16 for sugercane and Rs. 6 for ordinary crop, or an average of Rs. 11 per acre; but there is an offer from cultivators to increase this rate up to Rs. 40 to Rs. 60 for sugarcane if they can get water by channel-irrigation in places where they can get their supply from wells. It may be stated here that any cultivator has to maintain a pair of bullocks and a man throughout the year for drawing water from well, and has to spend at least Rs 8 per month on this. Where there are no wells the initial cost of construction and the interest the cultivator has to pay is too much in comparison to the water charges; hence he therefore finds it cheaper to pay Rs. 40 in place of spending Rs. 96 in a year. The average rates will be thus Rs. $\frac{40+15}{2}$ = 27½ in future.

(2) The average annual rate per acre paid on account of irrigation by the cultivator to the owner of land in the form of enhancement of rent is about Rs. 88.

(3) The owner pays out of this Rs. 10 to Rs. 14 to the Government as the revenue of the Bágáyat land.

In each case the wate-rate is charged to the cultivator on the area actually irrigated during the year, while the owner and Government receive their rates irrespective of the land irrigated.

29. The preparation of land for irrigation and the excavation of channels to bring water to the fields are done by the tenants at their own cost, and with the consideration of such expenses he makes his contract with the owner every year until he can convert the land into the Bágáyat.

30 & 31. The maintenance charges are trifling as the principal channel is maintained by Government and it does (not?) cost more than Rs. 25 to look after their supply of 100 acres of land per month. No legislation is required.

32. It is neither advisable nor feasible to encourage and assist the construction of irrigation tanks by private persons.

33. Up to this time not much inconvenience is experienced from the silting of tanks. As most of the tanks get their supply from the hilly parts, very little quantity of silt is brought in, and I do not think the depth exceeds on an average 2 per year as I can say the depth in the Kalamba Tank has not exceeded 2 in the plain portion though it has been constructed 20 years back. There is no custom in this District to remove silt.

E.—Wells.

34. The main tracts into which this District can be divided are two, namely, the Konkan or the hilly range, and the plain country. In the Konkan portion there are four talukas, namely, the Gad Hinglaj, Bhudhargad, Panhála and Karwir, and in the latter Shirol, Alta, Ráibág and Katkol. In these first four talukas we get ample rainfall and supply from rivers by throwing temporary earthen bunds, and hence there are very few wells constructed in these talukas. However, the following data can be admitted for wells in the above-said two tracts :—

	Konkan.	Plain country.
1. Average depth of permanent wells .	30 to 40 feet.	30 to 50 feet.
2. Nature of supply .	Percolation and small springs.	Springs.
(*a*) Failure in ordinary year.	Do not fail ...	To some extent, though not seriously.
(*b*) In year of drought ...	To some extent.	Total failure.
3. The average cost of construction including lining...	Rs. 2,000	Rs. 3,000.

4. The wells well constructed with lining masonry last for any length of time.

5. The water is raised by means of *mot*.

6. The average area attached to and commanded by a good well, allowing two *mots* to work, is about 10 acres, out of which 5 for sugarcane and 5 for other crops.

7 The average area actually irrigated by one well in any one year is five acres.

35. (1) People are not fond of planting two harvests instead of one.

(2) As stated above under the heading of tanks, they prefer to substitute valuable crops. I may quote an instance of a field of ten acres commanded by a well. In a year of ample rainfall the cultivator can produce 2½ khandis rice worth Rs. 150 and 25 khandis of jaggery with about Rs. 1,250 Thus the irrigation increases the original produce from Rs. 300 to Rs 1,400; but in the case of a year of scanty rainfall he is unable to plant sugarcane and has to depend on the supply of water from his well and can get at the utmost two crops worth Rs. 600. Thus in the first kind of year the cost is increased about 4½ and in the latter two times. In the year of drought it is practically difficult to

expect any. As regards the yield, I beg to state, as explained above, that people substitute special kind of crop when they get irrigation, and I am thus unable to supply this information.

(3) The increase in the total annual value of the produce per acre, as explained above, is Rs. 30 without and Rs. 140 with the well irrigated on the average of a normal term of years, and Rs. 60 or less in a year of drought.

37. The cultivator in this case pays to the owner less than he pays in the case of field under tank irrigation: as he has to undergo expenses of drawing water he pays on an average Rs. 60 to the owner.

(2) The owner pays to Government in the shape of revenue-Rs 10 to Rs. 14.

The above rates are paid on the total area commanded by a well.

38. No serious difficulties are encountered in the selection of a spot as well as in the construction of the well.

Assistance has neither been up to this time offered by Government nor asked by people who depend more upon their superstitious traditions in sinking a well, and I do not think people would like to take an advice and I would not therefore recommend such. *Mr. D. A. Vechare. L.C.E.* 19 Dec. 01.

39. I am not in favour of constructing wells on private land by Government as their construction will be found more costly and difficult to manage. Wells in this District more or less run through muram and trap rock which any cultivator is able to excavate and erect the means of drawing water.

40. They are temporary wells commonly used in this District. They are generally excavated near the beds of rivers and nallahs, and in the year of drought they help to irrigate land adjacent to river beds to some extent. It is also not found necessary on the part of Government to encourage the construction of such wells, and the people are accustomed to have them wherever they could be possible and whenever they are in need.

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1. *Q.* (*The President.*) You are Executive Engineer of the Kolhapur State?—Yes.

2. *Q.* How long have you been there?—Six years.

3. *Q.* What were you doing before that?—I was in the British service in the Kanara district.

4. *Q.* You are now serving under the Darbar of Kolhapore?—Yes.

5. *Q.* You say, "loans are not freely taken by the people under the Land Improvement Act as one would expect," and you then go on to refer to the delay in obtaining advances?—Yes, the people do not get the money at the time when they want to produce certain crops. They get the money when they don't really need it.

6. *Q.* Have they to pay something to the subordinates before getting the money?—Yes.

7. *Q.* You do not recommend any reduction in the rate of interest?—No, the people gladly pay 6 per cent.

8. *Q.* You do not recommend partial remissions?—No; except in the case of failure. I do not recommend total remissions.

9. *Q.* You recommend extension of period of payment which is at present Rs. 100 a year?—Yes, generally the maximum advance made by our State is Rs. 500.

10. *Q.* They pay it in 5 years?—Yes.

11. *Q.* Are there a great number of tanks in the Kolhapore State?—There are about 8 or 9 small tanks, but no big tanks. During the last famine we constructed three tanks and there were about two or three old ones.

12. *Q.* Did the famine make itself felt seriously in Kolhapore?—In 1896 the whole district was affected. Afterwards only three *pettas* on the Belgaum side suffered to some extent.

13. *Q.* You did not have a famine in 1899?—No; it was bad in only two talukas; but in 1896 it was bad throughout the whole State.

14. *Q.* How many tanks have you got altogether?—About 8.

15. (*Mr. Muir-Mackenzie.*) Have you any small rice tanks like those in Belgaum and Dharwar?—No; we generally produce sugar cane.

16. (*The President.*) What do you think would be a good thing to protect Kolhapur, supposing famine were to come again?—Irrigation by small tanks and wells only is feasible.

17. *Q.* Could you make more tanks?—We could make small tanks which would irrigate only 50 to 100 acres, not big ones.

18. *Q.* Why not big tanks?—We have no sites.

19. *Q.* Not on the ghats?—On the ghats we don't want any as rain is ample.

20. *Q.* You could not make one as big as the Kharakwasla?—No; we could not.

21. *Q.* What labour could you give the famine-stricken on small tanks?—Excavating, converting uncultivated areas into culturable areas; and throwing earthen *bunds* across the river.

22. *Q.* Do you think there is much room for the extension of wells?—There are possibilities.

23. *Q.* You would give facilities by granting takavi?—Yes.

24. *Q.* Have the people shown any desire for wells since the famine?—Yes, in the two years we have increased the number by 1,000. Every year the number goes on increasing.

25. *Q.* Does the Darbar give as much money in takavi as is asked for?—No, I do not think so; Rs. 500 is the maximum.

WITNESS No. 33.—RAO SAHEB B. V. JADHAV, M.A., LL.B., Assistant Plague and Famine Commissioner, Kolhápur State. *Mr. B. V. Jadhav.* 19 Dec. 01.

Answers to printed questions.

A.—GENERAL.

The answers refer to the whole of the Kolhápur State excluding the feudatory jagirs of Vishálgad, Bávda, Kágal, and Ichalkaranji, as I have no personal knowledge about them. But their condition differs so little from that of the adjoining tálukas of the State that the answers are in my opinion applicable to them also. I was attached to the Chief Revenue office and had to do a lot of district work in the fair season and then I was made a District Officer. Latterly in 1899 I was on special duty as Assistant Famine Commissioner.

2 The average rainfall will be seen from the following table:—

No.	Name of Táluka or Mahál.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.	In. c.
1	Karvir Táluka .	0 48	...	0 23	1 28	2 9	6 7	9 72	8 85	3 66	2 93	...	...	35 31
2	Panhála „ .	...	0 34	0 34	2 16	1 36	15 50	24 16	15 66	4 15	3 84	0 99	0 15	68 75
3	Bhudhargad „ .	0 2	0 16	0 29	1 14	1 69	14 13	21 2	13 14	4 37	3 49	0 50	0 15	60 1
4	Gad Hinglaj „ .	0 9	0 6	0 71	2 40	0 62	9 43	7 65	6 37	2 45	1 86	0 37	...	32 1
5	Shirol „ .	0 27	...	0 92	1 58	2 47	2 62	2 54	2 98	4 41	2 18	0 4	...	20 1
6	Alte „ .	0 12	0 4	0 65	2 27	1 88	4 28	4 82	5 65	3 73	2 44	...	...	25 88
7	Raibag Mahal .	0 2	...	0 60	2 26	2 22	3 73	1 95	1 48	4 64	4 78	0 31	...	21 39
8	Katkol „ .	0 17	...	0 22	3 13	3 58	2 33	1 26	1 45	4 64	2 29	...	...	19 7

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3. There is no obstacle to the extension of irrigation arising from any of the causes mentioned in the question.

4. The only irrigation works constructed by private capital are the permanent or temporary wells. The land assessment is not raised at once on account of the land from a dry crop one to the garden class, but the original assessment is levied until the completion of the period of the survey settlement. When under the revised settlement such land is assessed under bágáyat or garden land. The duration of the survey settlement is 30 years. The relations between landlords and tenants are governed by mutual contracts, and few of the tenants will care to spend capital on sinking wells, which on the expiry of the tenancy will be property of the landlord. The rules about the enhancement of assessment on account of the sinking of a well at the time of the revision settlement deter many of the holders of land from expending capital as the time of the revision survey approaches. I would suggest that the land should be exempted from the enhancement of rent for at least 25 years from the date of the first irrigated crop.

5. The loans under the Land Improvement Act are not freely taken, as the period between the date of the application and the date on which the money is paid to the applicant is sometimes a lengthy one. It is feared that some portion of the money goes into the pockets of village accountant, whose certificate about the solvency of the farmer is necessary. I would propose that the inquiry should be held by the Mámlatdár on the spot, and he should rely on the report of the sub-register that the land is unencumbered under any registered instrument. This will not lessen the period between the date of the application and the actual receipt of the money, but by this method the whole of the sum is likely to go into the hands of the agriculturist.

(1) The rate of interest is sufficiently low and need not be reduced;

(2) not remitted.

(3) and (4) partial remission may be given if the attempt to obtain water fails, because the pit so dug will hold some water and will enable the agriculturist to raise short-time crops.

(5) The period of repayment is only five years; it should be extended to ten years.

(6) No grants-in-aid need be given.

6. The population being sufficiently dense, *viz.*, 296·7 to the square mile, there is no fear of the extension of irrigation leaving unirrigated land untilled. The questions under "B—Canals of continuous flow" and "C—Canals of intermittent flow" need not be answered as there are no canals yet constructed The rivers are dammed in certain places and the land irrigated by means of the water thus stored; but the water is always raised by a series of water-lifts before it runs through channels and irrigates the land. The supply of water is plentiful, unless the rainy season closes abruptly and the dams are not thrown early enough to catch water.

D.—Tanks.

23. (1) The tanks in the district are generally filled during the rainy season which is generally sufficient to fill the tanks. There are only a few tanks, water from which is used in irrigating the land.

(2) The water is distributed by channels dug along the contour lines.

(3) The supply is required for only eight months in a year as the land is not irrigated during the rainy season, unless there is a drought. These tanks are full nearly every year unless there is a succession of bad years.

(4) The area irrigated varies from 200 acres to 10 acres from each tank.

24. (1 and 2) The farmers do not prefer to take two harvests, but they generally raise the sugarcane and turmeric crops which they consider very profitable.

(3) (*a*) The increase is nearly five times as the cultivator generally raises alternate crops and saves his land from exhaustion.

(*b*) In a year of scanty rainfall sugarcane cannot be raised and short-time crops are taken; the yield is about two times.

25. (1) There cannot be too late commencement of irrigation.

(2) And if the supply of water fails too early the whole of the sugarcane crop is lost.

26. Irrigation from tanks is not supplemented by irrigation from wells.

27. (1) An acre of dry crop land assessed at Rs. 5 will yield jnari valued at Rs 30: but if it is irrigated and cultivated with sugarcane the produce will be worth about Rs. 150: but if with the betel leaves, the produce will be worth about Rs 300 per year on an average of ten years.

(2) In a year of drought the water will be sufficient to irrigate the lands for four or five months only, and wheat, onions, garlic, maize and such other crops are raised. The outturn of these crops is about Rs. 30 per acre in addition to the first crop.

28. (1) The water-rate is Rs. 16 for sugarcane and Rs. 6 for other crops per acre in Kolhápur. This is too low as at other places the cultivators are willing to pay as high as Rs. 50 per acre for sugarcane and sometimes even higher.

(2) The increase per acre is about Rs. 40.

(3) Assessment is enhanced on the completion of the revision survey and not till then. Water-rate to Government is paid on the actual area irrigated. The second cases are governed by private contract.

29. The main channels are made and maintained by the Government, but the sub-channels are made and maintained and the expenses to prepare the land for irrigation incurred by the cultivator, whether he be the owner or tenant. If made by the tenant, the expenditure is taken into consideration when the lease is accepted.

30. The tanks are maintained at Government expense, and it is found that very little silt accumulates. The system works fairly well and no new legislation is necessary.

31. No tanks are constructed by private persons.

32. It is not advisable to encourage private persons to construct tanks unless the capitalist owns all the land to be irrigated and to be covered by the tank and the catchment area.

33. The accumulation of silt is very slow. No silt is removed by dredging.

E.—Wells.

34. (1) The average depth of a permanent well in the Karvir and Panhala Talukas is about 35 feet and in Shirol Alte, and other talukas about 50 feet.

(2) The supply is mainly from springs and not liable to fail in an ordinary year; but in a year of drought it is otherwise and liable to fail from February. Water does not become saline.

(3) The average cost of construction varies from Rs. 1,000 to Rs. 3,000 according to depth and nature of the rocks through which the well is sunk.

(4) A permanent well, if well maintained and repaired and cleared, lasts for nearly a century.

(5) The water is raised by water-lifts—*mots*.

(6) The average area commanded by a well is about six acres.

(7) The average area irrigated by a well with water sufficient for the working of a single *mot* is about an acre and a half for sugarcane.

35, 36, and 37 are answered under questions Nos. 24, 27 and 28.

38. (1) The cultivators manage the sinking of a well. They consult such persons as are considered to be adepts in locating the underground springs, and in at least 75 cases out of 100 these experts keep up their reputation.

(2) If no solid rock or other hard strata are met, the construction is very difficult for want of a sufficiently sound foundation, and sometimes such wells are abandoned.

No assistance has yet been offered and none is asked. But I think a free use of boring tools will be much appreciated and made use of. The cultivator will not take any out side expert advice as the one he now gets is generally successful.

39. I am not in favour of wells being constructed by Government in private lands, as the sinking of a well cannot be managed as economically by the Government as by the cultivator. When he appreciates the advantage of a well he will prefer to borrow a loan than to hire a well from Government.

40. Temporary wells are used. They are dug in the beds of nallahs which run dry or in which there is very little flow, but in which there are underground currents. These do

not afford much protection against drought, as then the underground currents are liable to fail; but as a prefectly dry season is unknown in the State, the temporary wells do get water for at least eight or nine months of the year. Famine takavi may be offered early in the season expressly for their construction, on condition that the cultivator raises a crop of maize or wheat. Thus temporary wells will be useful as they do not generally cost more than Rs. 10.

1. Q. (*The President.*)—You are Famine Commissioner in the Kolhapur State?—Yes, I am on special duty.

2. Q. What were you before?—I was a District Revenue Officer.

3. Q. What do you think would be the best thing to do in your State to prepare it against famine?—The territory might be divided in two divisions, western and eastern; the eastern division is liable to famine; the western is not, as it is near the hills.

4. Q. I see Kavir got only $\frac{1}{3}$ an inch of rainfall in January?—That is quite sufficient; there are a number of rivers flowing through that taluka, consequently water is plentiful, and it is not liable to famine.

5. Q. Do the rivers never fail?—Never.

6. Q. Have they flowed during the last two years?—Yes, the average crop under them was more than eight annas.

7. Q. It is different in the eastern talukas?—Yes, especially near Bijapur; it is detached and there is famine there every five or ten years.

8. Q. The rainfall is only 15 inches?—Yes, but they very rarely get that.

9. Q. What are the best steps that can be taken to protect the unhappy talukas visited by famine from time to time?—There are no good sites for making large reservoirs, but small tanks might be made, and the rayats might be induced to make *bandharas* in their fields, so that they can accumulate water which will result in sub-soil water being secured.

10. Q. Do not the rayats do it now?—They have commenced to do it during the last five years, and a number of *bandharas* have been put up. Such fields were very well off, even in the bad years that have visited us.

11. Q. Near the eastern talukas, do the rivers maintain a good flow?—In Raibag there is only one river, the Krishna, which flows on the northern side, so that the villages there always do very well. They did particularly well in the famine years. In famine years, the crops were excellent, and above normal.

12. Q. How do they get water from the Krishna?—The river overflows and inundates the land, which yields excellent crops.

13. Q. Is the area wide?—The water spreads over three or four miles—generally from two to three miles—to the eastern boundary of Shirod taluka.

14. Q. The Krishna does not lie in a deep channel?—No.

15. Q. The floods are very heavy?—Yes.

16. Q. Where does it take its rise?—In Mahableshvar; there are a number of rivers to the east. Kolhápur has about seven rivers running through it.

17. Q. Where are the talukas which suffer?—On the eastern side.

18. Q. Does the Krishna go on irrigating two or three miles the whole way?—I have seen it overflow as far as Radhan.

19. Q.—Are no small tanks fed by it?—No.

20. Q. Is it not possible?—The tanks that are constructed fill during the rains. At Raibag there is a big tank which is filled by rain.

21. Q. Was it filled last year?—Yes, it filled last year.

22. Q. In 1896 was it full?—Yes, but the dam was imperfectly constructed and so the water leaked out.

23. Q. One of the talukas suffered very much in 1896?—Yes, because the rainfall was too heavy in the earlier part of the monsoon, and there was no rain in September. The crops under the Krishna were good.

24. Q. Would you advise the construction of small tanks?—I would prefer wells, because they can be very easily managed by the cultivators themselves.

25. Q. What does a well cost in Kolhápur?—It depends upon the depth of the spring. In the western portion the construction of wells is not so cheap as it is in the eastern portion, where water is tapped near the surface. The cost varies from Rs. 1,000 to Rs. 3,000.

26. Q. They are expensive?—A temporary well is cheaper.

27. Q. How deep are these wells generally?—In the eastern portion 60 feet is the maximum.

28. Q. Do the people often fail to get water?—Yes.

29. Q. Do you think that there should be some remission if water is not found?—If they don't find water, a partial remission should be granted; but there is no need to grant remission of the whole amount advanced.

30. Q. You think that the fact that repayment is required in ten years is not a deterrent?—No.

31. Q. Is it not to the interest of the Darbar to have the number of wells increased?—Yes.

32 Q. The famine has cost you how much?—In 1896 about six lakhs were spent.

33. Q. Do you think it would be well to give takavi advances?—I think so. Lately the resources of the State were turned towards combating the famine; therefore, very small sums were given as takavi loans under the Land Improvement Act.

34. Q. Have you adopted the Land Improvement Act in Kolhápur?—Not entirely, but some sections of it.

35. Q. You say the water-rate is Rs 16 for sugarcane and Rs. 6 for other crops?—That is for Kolhápur town only. The cultivators there are treated very leniently: it is a ridiculously low rate.

36. Q They could pay an increased rate?—Yes, some people are willing to pay a higher rate.

37. Q. (*Mr. Rajaratna Mdlr.*)—That is for sugarcane?—Yes, that is the only crop for which cultivators care to take water.

38. Q. What is your *rabi* crop?—We have all sorts of *rabi* crops—gram, wheat, onions, etc.

39. Q. *Juari*?—Yes; *juari* is not irrigated.

40. Q. Are gram and wheat irrigated?—Gram is not irrigated, but wheat is.

41. Q. Irrigated by wells?—By wells or by channels from the rivers or nallahs, because wheat requires four or five waterings.

42. Q. (*Mr. Higham*)—You say that in certain places water is lifted?—Yes, in the western side, from ponds.

43. Q. What sort of dams have you got?—Temporary earthen dams.

44. Q. They are made up every year?—Yes.

45. Q. You don't do it on small rivers?—No.

46. Q. If a flood comes, the dams are washed off?—Yes.

47. Q. When do they begin the making of dams?—In August or September.

48. Q. When does the river fall?—Generally [illegible] tember.

49. Q. Are the dams made by the villagers themselves or by the State?—By the villagers themselves.

50. Q. How much does it cost to make a dam?—It is not generally estimated: they have got their own labour which is never paid for; a number of villagers club together and do the work.

51. Q. They provide their own labour?—Yes, they manage very well among themselves: they do not get any outside help.

52. Q. Have you any idea how much such labour would cost?—It will cost something like Rs. 500 to Rs. 600.

53. Q. Every year?—Yes.

54. Q. What do they produce?—Sugarcane.

55. Q. It is a pretty large area?—Yes; sugarcane is not a profitable crop; but, at any rate, it keeps them employed all the year round, and so they prefer it.

56. Q. You propose making a number of small tanks?—Yes.

57. Q. What crops do the people generally irrigate?—Generally sugarcane: if the water is not sufficient, they go in for short-time crops like wheat.

58. Q. Not rice?—No; rice is not watered there.

59. Q. Why?—Because it is a *kharif* crop.

60. Q. Is it coarse rice or fine rice?—Both.

Mr. B. V. Jadhav.

19 Dec. 01.

61. *Q.* Does not fine rice want water after the monsoon? —This rice is on the hills.

62. *Q.* Where there is plenty of water?—Yes.

63. *Q.* But they do grow rice?—Yes, a few acres.

64. *Q.* If these tanks pay well, why are more not made. Have you got sites?—Yes, we have got sites. There are also many old tanks in Kolhápur, but they are out of repair.

65. *Q.* How many are there?—There are small tanks in nearly every village.

66. Q. For drinking purposes?—Yes, and also for cattle; not for irrigation.

67 *Q.* Are they out of order?—They are not sufficiently capacious to be worth repairs.

68. *Q.* Why are not irrigation tanks built in the western part of the country?—Because famine is not known there.

69. *Q.* Can you give any reason why there are no irrigation tanks in Kolhapur?—Perhaps, it is because the rainfall is plentiful, and no necessity for tanks exists.

70. *Q.* (*Mr. Rajaratna Mdlr.*)—What is the cultivable area of the State?—About 1,700 square miles in Kolhápur proper.

71. *Q.* How many acres are actually cultivated that are held under *pattas*?—About 67 per cent., and the waste land is 8 per cent.

72. *Q.* The remaining lands are unculturable?—Yes.

73. *Q.* The total area is 1,700 square miles?—No, the total area is 2,300 square miles, out of which 1,700 square miles are culturable, and of this 8 per cent. is not cultivated.

74. *Q.* What proportion of the area is irrigated?—A very small proportion.

75. *Q.* About 5 per cent.?—I think, it would be about 7 per cent. from wells and tanks. That is my impression: I have not got any statistics.

76. *Q.* Can you give us the number of wells used for irrigation purposes?—I have here the total number of wells in the State, but I cannot distinguish those used for irrigation purposes from the others. The total number is about 11,000 at present, and 1,900 were added during the last ten years. I think the increase is due to irrigation.

77. *Q.* Is there a periodical settlement in the Kolhápur State?—Yes, once in 30 years.

78. *Q.* Money rents are fixed?—Yes.

79. *Q.* On all lands?—Yes.

80. *Q.* In paragraph 32 you say: "It is not advisable to encourage private people to construct tanks, unless the capitalist owns all the land to be irrigated and to be covered by the tank and catchment area." Supposing an enterprising capitalist enters into an arrangement with private cultivators, why should he not be allowed to construct the tank?—Then the whole land would be at his disposal.

81. *Q.* If he enters into an agreement to sell water at a certain rate he need not necessarily be the owner of the land? —There is no objection, provided there will be no disputes afterwards, and that the assistance of the State will not be required to settle disputes.

82. *Q.* Suppose he enters into such an arrangement?—We have no objection.

83. *Q.* What enhanced rate would be levied in such cases? —The Survey Superintendent will have to take all the circumstances into consideration when he makes the settlement.

84. *Q.* What would be the probable enhancement?—About Rs. 2 to Rs. 3 per acre.

85. *Q.* And if the work is constructed by the State?—Then the State levies a water-rate, which is Rs. 16 in Kolhápur for sugarcane, and at other places rather higher.

86. *Q.* Where the work is constructed by the rayat, there would be a substantial reduction?—Yes.

87. *Q.* About one-fourth?—I think it would be even more than that.

88. *Q.* (*Mr. Ibbetson.*)—When cultivators combine and make these *kachcha bunds* across the streams, does the State charge anything for the water?—Nothing.

89. *Q.* Nothing at all?—No.

MINUTES OF EVIDENCE.

THIRTY-FOURTH DAY.

Bangalore, 18th January 1902.

PROCEEDINGS OF THE GOVERNMENT OF MYSORE, REVENUE, DATED 24TH JANUARY 1902.

READ AGAIN—

Government Proceedings No. 4115-7-R. 1414, dated 5th November 1896, directing a reclassification of rice and garden lands in Davangere and six other taluks of the Chitaldrug district with special reference to the value assignable to the water-supply now enjoyed by the lands.

Read—

Memorandum by the Superintendent, Revenue Survey, received in August 1901 on the subject of treatment at revision of assessment of gardens irrigated by means of wells.

No. R.3138-46-R.F.8-1900, Dated Bangalore, 24th January 1902.

ORDER THEREON.—After mature consideration, the Government of Mysore are pleased to direct that the revision of assessment on well-irrigated lands be carried out at the re-survey according to the following principles:—

(I) Well-irrigated land brought under irrigation since the last settlement to be assessed at simple dry crop rates, if the wells belong to class I; and within the highest dry rates, if the wells fall under classes II and III.

(II) Well-irrigated land recorded as such at the last settlement should be assessed at dry rates, if the well supply has failed.

(III) Well-gardens, recorded as such at the last settlement, shall be assessed within the highest dry crop rate, if they solely depend on wells which received no aid directly or indirectly from Government works and fall under class I.

(IV) Well-gardens recorded as such at the last settlement if they are irrigated from wells falling under class II or III will be assessed on their merits.

(V) Well-gardens enjoying both well and tank supply (class IV) should be assessed on the superior supply, *i.e.*, the tank.

(VI) The existing rates on lands referred to in rules II, III, and IV, above, are not to be raised at the revision.

The following is a rough description of the classes of wells referred to above:—

I. Wells purely self-dependent situated neither below or above any Government tank, nor below any Government channel, subdivided as follows:—

(*a*) Pukka wells, crops grown various.

(*b*) Cheap, often merely temporary wells used for what is known as "Khushki Bagait," almost always cocoanut cultivation, water only necessary whilst trees are young.

II. Wells sunk all along the banks of streams and for the most part outside the boundaries of the occupancies they irrigate. These wells are not very costly.

III. Wells sunk within a tank series, either above or below a Government tank or below Government channel. These wells are directly or indirectly dependent on Government works; when they are in the "Atchkat" of a tank, the holders prefer the percolation to supply by gravitation from the tank or other work. They like having complete control over the water they use. In all these wells, the existence and maintenance of Government tanks is of vital importance as keeping up the level of the water in the wells.

IV. Wells under a tank or other work and only supplementary to the tank or channel supply.

WITNESS No. 34—Colonel J. P. GRANT, Superintendent, Mysore Revenue Survey.

Written Evidence.

Colonel Grant.

18 Jan. 02.

Confining my remarks and replies strictly to points with which I am conversant from personal observation, or regarding which the operations of my department have naturally put me in possession of some information, I submit the following:—

Query 1.—I know the whole Province pretty intimately, having personally settled seven-eighths of the taluks, and have also been present at the earlier settlements in 1863, although at that time only in charge of measuring and classing operations, which however enabled me to see the country very minutely.

3. (2) and (3) of this question are embraced by (1). If population be sparse it would be unreasonable to expect (excepting in purely grazing tracts) many cattle, and consequently much manure; for, excepting leaf manure from the Honge tree (*pongamia glabra*) used, wherever available, chiefly in the eastern district of Kolar, no other manure is made use of. The most sparsely-populated portions of the Province are the taluks of Challakere in the Chitaldrug district and the taluk of Pavagada in the Tumkur district. The taluk of Hiriyur in the Chitaldrug district is also very poorly populated. Viewed as a district, Chitaldrug is the most sparsely populated tract in the Province; but the population is unequally distributed, decreasing from west to east. The holdings in the eastern parts run very large and the dry crop lands are but seldom manured. The large stretches of black-cotton soil are annually cultivated, but the red and sandy stretches, being never manured, are put under crop only once in two or even three years. The western part of the district contains much smaller holdings, enjoys a better rainfall, and manure is used more or less. The above remarks apply to dry crop lands. Garden and wet lands, wherever situated, are manured. The question asked is, whether such a state of things as I have described constitutes an obstacle to the extension of irrigation. Irrigation is more prized in the eastern and bad parts than in the western and better parts, because, in the former the people have nothing else to depend upon, their dry crop cultivation being quite insufficient for their existence, while in the western and better part dry crops are remunerative. I may safely say that the sparsity of population is no obstacle to the extension of irrigation, for the people, never manuring the dry lands, have enough manure for the irrigated lands, which are not available to the extent the people are quite prepared to undertake. There are, fortunately, many natural springs called *talpargis* in the eastern taluks, which are made use of by long channels led from their source, and every stream and likely low-lying spot is eagerly competed for. The eastern rayats are far more skilful cultivators of wet land than the western rayats who, having dry crops to fall back on, are callous about irrigation and unskilful in regard to the little they have.

(4) The suitability or otherwise of the soil to irrigation is a question of enormous importance. The question turns entirely upon black-cotton soil, for we know that other soils may be pronounced suitable, but regarding the suitability of black soil opinions are divided. There are considerable stretches of black soil in the Davangere, Chitaldrug and Hiriyur taluks. If black soil is unsuitable to irrigation, important works of irrigation contemplated or in hand will be defeated in their main object and will certainly not be remunerative; the Marikanave Project, for instance. I will briefly give my opinion for what it is worth. We know that the rayats who occupy black soil, rightly or wrongly have some prejudice against using irrigation. They have hardly even made the experiment, the real truth being that the dry cultivation of black soil is very easy and a bumper year makes up for several years of bad yield. Moreover, the rayats of these black-cotton soil parts are quite unaccustomed to irrigation. Could the Pavagada and more eastern rayats be imported to Hiriyur, I have no doubt they could make something of the opportunities offered. My own

Colonel Grant.

18 Jan. 02.

opinion is that black-cotton soil does not admit of regular irrigation, and that the means of irrigation provided, water would go little farther than saving the crops by moderate waterings. I speak here of irrigation for ordinary dry crops. If black-cotton soil be converted into what is known as wet land, I believe that it will take several years before good crops are obtained, and then only because sand and other earth has gradually been intermixed and the whole has become friable.

(5) Uncertainty of supply of water is a factor in depreciation everywhere. In all excepting the most western parts of the Province where tanks are of little count and rarely constructed, there is always more or less uncertainty as to whether a tank will fill. Speaking in general terms, this uncertainty is the greatest where the rainfall is least. A bad rainfall is of course an obstacle to extension of irrigation; but on the other hand a country possessing a bad rainfall is just where irrigation is most necessary and most appreciated. The tanks in the eastern parts of the Province trust to the North-east Monsoon for their filling, those in the central and western parts to the South-west Monsoon; consequently, in the former case the rayats wait for what are called "Vaisak" or late crops, in the latter the rayats take, indeed generally are forced to take, "Kartik" or early wet crops. Such conditions no doubt involve uncertainty and risk, but it could not with accuracy be said that they are an obstacle to the extension of irrigation.

(6) Lack of capital there no doubt is; but, as I have already observed, there will be no want of rayats coming forward, especially in the eastern parts of the Province, if the land and the means of irrigation are offered them. These eastern rayats are the men who should be encouraged by grant of loans and assistance generally They are the most industrious of all our rayats and would repay what was lent them.

(7) I do not believe that the fear of enhanced revenue assessment enters into the calculations of rayats in taking up land, irrigable or otherwise.

(8) I believe the tenure in Mysore to be as sound and secure as any in India

(9) I know of no reason why irrigation should not extend when soil and water are available. There is of course the black-cotton soil uncertainty, and there is also the extreme reluctance on the part of rayats, unaccustomed to irrigation, to commence a new mode of cultivation. These points, especially the first, cannot be disregarded.

4. What are known as "swant kere" or private tanks, when repaired or constructed, and maintained, by private individuals, pay only three-fourths of the full wet assessment. This concession is permanent, only the full assessment is liable to revision when a fresh settlement is made. An occupant, under the Survey Settlement, can construct a tank in his own land to irrigate lands in his holding, and there will be no enhancement of the revenue assessment. I consider the above concessions sufficiently liberal.

6. The extension of irrigation does not injure other cultivation: on the contrary, it favours it, inasmuch as more capital is produced. Dry cultivation may stand in the way of irrigation of other lands but never can irrigation stand in the way of dry cultivation.

7. I am not clear as to what is meant by a canal of continuous flow In the case of river channels led from rivers like the Cauvery in Mysore, the water is usually shut off in January and is afterwards let on for ten days at a time for the irrigation of sugarcane. If by continuous flow is meant that the water is let on at all times and two harvests rendered possible, the value of the produce of land would be enormously increased. A not unfair estimate is given below, not based on any average, but still applicable to land which has come under my notice:—

Description.	Produce-value Rs.		
	Year of ample rain.	Year of normal rain.	Year of drought.
Dry cultivation	20	16	2
River channel, two harvests ..	90	90	90
River channel, single harvest ..	60	60	60

In my experience the supply from a good river in Mysore varies little. The *value* of the produce would probably be greater in a bad year, but this I have not allowed for. It is impossible to say too much of the value of river channel irrigation.

9. (1) In Mysore there are no private owners of river channels or canals.

(2) The commonest practice is for the owner to sublet on "waram" or half the gross produce, and sometimes on "gutta" or fixed rate coming to about the same figure. In either case the owner pays the revenue assessment. This rate must necessarily be on the area actually cultivated.

(3) Under a channel drawn, say, from the Cauvery, Rs. 8 per acre would be a high rate; Rs. 4 per acre would be a comparatively low rate. The difference would be due to difference in facility of water-supply, difference in class of soil, and deteriorating qualities in the soil, as for instance salt efflorescence. Both water and soil class are combined to work out the rate of assessment. The rate is paid on the whole irrigable area in occupancy.

10. So far as I am aware, the maintenance of the minor distribution channels devolves on the occupant or tenant; that of the main channel on Government. I never have heard of recoupment being given or asked for.

11. Salt efflorescence, "upalwat," or water-logging, the presence of any deteriorating quality or defect in the soil, are, when met with, duly allowed for at time of classification and the rate reduced accordingly. Water-logging is not very common; the remedy is drainage. Drainage is resorted to in plantain gardens and in betel-nut gardens.

12 to 21. The canals here alluded to I take to mean channels led from interior streams, compared with class B. There are a few such channels in Mysore, but the dams are not necessarily temporary. I need not repeat my remarks on queries Nos. 7 to 11 which apply, in a modified degree, to these less pretentious channels.

22. I do not consider it advisable to encourage and assist the construction by private persons of works taking such high rank as river channels.

D.—Tanks.

23. (1) The tank system has been developed to an extraordinary extent all over the Province, in the Kolar district perhaps more than anywhere else; but Mysore, as a whole, possesses more tanks than any other equal area in India. The Engineer, the Revenue officer, and the rayats have from time immemorial been in search of suitable sites for tanks. It was one of the chief and most interesting duties of the Revenue officer, and the rayats were invariably pointing out what could be done. Under such circumstances, in a country peculiarly adapted to the purpose and containing many facilities, an immense number of tanks have been constructed. They are the life of the country, and three-fourths of the wells in the Province are directly or indirectly dependent on them.

(2) Almost every village which possesses a tank has "its nirganti" or hereditary village servant, whose duty it is to regulate the distribution of water.

(3) The period for which the water supplied lasts varies in every possible degree from the first-class tank to the humble "katte" or pond irrigating only two or three acres. Very few tanks are really first class. Two harvests are quite the exception, still they are taken in a few instances. By far the majority of tanks suffice for only one harvest: certain under the better tanks, precarious under the ordinary tanks—according to the season. Some tanks fill every year, the channels running up to March and April; others fill only once in three or four years; and why this difference should exist even an Engineer would find it difficult to explain. The area irrigated in some cases is ludicrously out of proportion to the supply stored. The assessment is fixed on the *average* supply of water during a number of years, and the ascertainment of this point is one of the most difficult duties of the Classing officer.

(4) A correct answer to this question is beyond human power. A thousand causes lead to more or less area being irrigated; the area available, the inclination, means, and skill of the rayats, the condition of the tank, and so forth.

24. We may assume that tank irrigation increases the value of the produce of land in every case but in countless degrees.

(1) Double harvests are rare.

(2) Gardens of perennial and valuable produce are more common under tanks than under river channels, and the class of the tank is no index to the superior garden cultivation in question. The reason why gardens under river channels are uncommon is that the percolation in the case of tanks is so much greater. Tanks are always constructed in low-lying situations; river channels run anywhere. Even the smallest tanks have sometimes superior gardens under them. Gardens unaided by wells are very rare.

(3) Already replied to under query 23.

25. Already replied to.

26. This is a very important question and will be replied to under E. Wells.

27. I cannot. Circumstances vary too much.

28. (2) The owner usually sublets on "waram" or half produce, owner paying the revenue assessment.

(3) Assessment varies in every possible degree, from almost purely dry crop rate to Rs. 6 or even Rs. 7. I speak of ordinary wet land growing rice and sugarcane. Betel-nut and other superior produce the State has from time immemorial asserted its right to share in, and garden rates run higher than ordinary wet rates.

In (2) the rate is of course on the area actually cultivated: in (3) it is on the whole irrigable area occupied.

29. Already answered under classes B and C.

30. The tank is the care of Government, also the main channels in the case of very large tanks. The distribution channels rest with the owner or tenant. I have never heard of recoupment being asked for or granted.

31. Government assists owners of private tanks with professional advice and work, when necessary. The owner maintains

the tanks. The minor distribution of water is very much the same as in the case of Government tanks.

32. Yes, in the case of repair and restoration of dilapidated tanks, but always under preliminary professional enquiry. The construction of new tanks I do not regard as a safe concession, nor yet the restoration of abandoned tanks, for they have probably been abandoned by Government intentionally. Carelessly granted permission might endanger the whole series of tanks.

E.—Wells.

34. (1) I cannot better answer this than by submitting for the inspection of the Commission (and kind return), a well map, which I had prepared for my own use, of the Chitaldrug district.

The lift of water from surface to roller or fulcrum varies greatly. In the Bangalore and Kolar districts, where water is near the surface, the *pakota* is used. These wells are exceedingly valuable and nearly all are dependent directly or indirectly on tanks. Water is often within 3 and 4 feet of the surface of the ground. Wells of this kind represent, in my opinion, the most valuable kind of cultivation in the Province.

(5) Depends entirely on depth of water. "Pakotas" where water is near surface. "kapile" wells where water is far below the surface.

(6) & (7) Areas vary so much that data for striking an average are wanting. The area commanded by a well is often limited by the area in the owner's possession. A deep well often irrigates from 3 to 4 acres. In Bangalore and Kolar districts the pakota wells are often shifted from one spot to another at pleasure, or as many new wells sunk as may be required.

35. In my opinion well irrigation produces the best crops in the Province. Irrigation from wells increases the value of the produce of land enormously, especially in districts like Bangalore and Kolar.

(1) & (2) Under wells the variety of crops raised is greater than under any other kind of irrigation. Superior garden crops, such as betel-nut, cocoanut, panvel (creeper) mulberry, are, almost invariably, irrigated from wells. A garden, cocoanut excepted, is rarely found without a well. The best vegetables are always under wells. The wells are in many cases supplemental to tank supply, but many gardens are raised under wells alone. In gardens under tanks the tank water is rarely used by gravitation; all the garden owners care for is the position, the watering is done from the well.

(3) No accurate estimate can be made—the yield *must* be greatly increased.

36. Any attempt to make such an estimate would be futile. I was informed on good authority that the gross yield per acre under some of the "pakota" wells exceeded Rs. 200 in value. The variety of crops raised is so great as to defeat any attempt at estimate which, to be of use, should be with reference to one particular crop.

(2) The supply is from springs in the case of deep wells, and from percolation and the high level maintained by the presence of tanks, in the wells in the Bangalore and Kolar taluks just described. I do not think there are many instances of the water becoming too saline. As a proof of the advantage of tanks to wells, I may mention that when a tank is for any reason abandoned, a storm of protest arises from owners of wells both above and below.

(3) The cost of wells varies greatly, from that of the cheap and often-shifted wells where water is near the surface to that of the deep wells sunk in less favoured spots. The wells sunk in the beds or on the edges of streams (a class not enquired about by the Commission) are very cheap. Unfortunately, the cost of wells is in inverse ratio to the value of the water when raised: in other words, the Kolar and Bangalore districts have the cheapest wells and the best cultivation; the Chitaldrug district has the most costly wells and inferior cultivation. Near tanks, wells are cheap; independent of tanks, they are costly. A well in the former case might cost Rs. 30 or 40; in the second case as much as Rs. 300 or 400. The "pakota" used indicates water near the surface; the "kapile" well, where the leather bucket is worked by bullocks on an inclined plane, indicates considerable depth. The "pakota" is common in the Kolar and Bangalore districts, the "kapile" wells are common in the Chitaldrug district—the inference is obvious.

(4) Wells near tanks last long; those independent of tanks and fed from springs are uncertain; new wells found near them often diminish the supply in the old ones. On the whole, the duration of wells in Mysore is good.

37. I do not think subletting is at all common in the case of well irrigated lands.

(2) The assessment paid to Government by the owner of a well varies from Re. 1 to even Rs. 8 or 10 per acre. In the case of "kapile" wells the rate is usually low. The rate is no proper indication of the weight of the assessment which is really on the well. A well irrigating only one acre when it was capable of irrigating 3 or 4 acres would have a comparatively high rate on that one acre. Conversely, a well irrigating to its full capacity, the rate would be comparatively low. The depth of the water from the surface, the cost of the well, and its duration (in hours working per day), are all factors in fixing the assessment. No lands are more prized than well irrigated lands, and on no lands is the assessment so easily and readily paid.

The rate paid to Government is on the area recorded at the original settlement as under irrigation; and if the owner extends the area under irrigation, no enhancement of revenue occurs, nor will any enhancement occur at a revised settlement.

38. In the case of "kapile" wells, difficulty no doubt occurs in selecting a spot, and the man who sinks the well often does not know when water will be met, and no doubt he runs a good deal of risk. In the high class "pakota" wells such difficulties and risks are few. Government has been extremely liberal in advancing money for the sinking of wells, but not I believe with very important results. As regards expert advice, I am inclined to believe that the rayat has not much to learn in the selection of spot and sinking; but in the matter of raising the water, expert advice would be of great use. Cost is the usual drawback in inducing the rayat to adopt any improved mode of raising water. What must be shown them, by exhibition at some central place, is a *cheap* method. Expensive methods they will have nothing to do with. An exhibition was once held at Mysore with the above objects, and many good methods were practically illustrated, but they were all too costly.

39. I do not believe in the practicability of the suggestion here made.

40. I have already stated that in the Bangalore and Kolar districts, and in short anywhere where water is near the surface, wells are not only cheap but are often temporary, their site being shifted frequently and new wells sunk as required. They are not only extremely valuable for the crops raised, but they eke out the means of subsistence wonderfully in bad years. A year of scarcity, if severe, is not a time when people care to engage in constructing wells, even when helped by Government. Every encouragement however should be given, and no more fitting object for the rules framed under section 194 of the Land Revenue Code (Government Proceedings No. 2548-56, dated 10th December 1901).

General.—The Commission have left out of their questionings some classes of irrigation which deserve a word of notice.

Malnad Rice Lands.—In the western (Malnad) tracts there are large areas of rice land dependent upon perennial hill streams unaided by tanks. The water-supply is very certain and a considerable proportion of the land is double crop and will continue to be so unless any unwise policy denuded the forests, when they would certainly revert into single-crop lands.

These rice-producing tracts (I say nothing of the betel-nut gardens of which the Malnad is the home) are of immense importance to the country generally.

Wells in Beds and Edges of Streams.—A far larger proportion of well irrigation than is generally supposed is conducted on the banks of streams, or rather in the holdings which adjoin them, by means of wells sunk in the beds or just on the margin of such streams. This is a very common feature in Mysore well cultivation, and fortunately such cultivation is found to a considerable extent in the eastern and north-eastern parts of the Chitaldrug district, of which I have given so unfavourable account.

"*Seguvali kattes*" *in black soil*.—In the black-cotton soil tracts in the Hiriyur, Chitaldrug and Davangere taluks of the Chitaldrug district there is a practice, very common, of running up embankments in favourable spots, not to hold water, but to collect silt and soil. In these "seguvali kattes," as they are called, even in bad seasons, jola, chenna and sometimes wheat and cotton, are raised, where elsewhere the crops are a failure. These works should be encouraged; at any rate they should never be prohibited. They do not concern the irrigation question, but are worthy of mention as an undoubted factor is in the guard against bad seasons. As bearing upon the question of irrigation so far as it can be affected by the revenue demand I may mention that the Government of Mysore has most wisely, indeed necessarily, sanctioned an entire reclassification of the *water* supply to all irrigable lands. This reclassification is completed in about six taluks and will be incorporated in the revision settlement. The measure ensures two desiderata—

1*st*, The wet assessment will be based on the data of the present time, not on the data of 30 years ago, since when many changes in water-supply have occurred.

2*nd*, A liberal policy in the revision of the assessment of well irrigated land will be possible, calculated to afford every encouragement to the present holders of wells and to others who may wish to sink new wells. It is premature to sketch the outlines of this policy, but I have no doubt it will be on liberal lines.

If I may be permitted to offer an opinion, I would say that the true policy for the Mysore Government to adopt, in view of the contingency of bad seasons, is a thorough repair of tanks, large and small, or major and minor, as they are defined. I have shown that three-fourths of the wells are dependent, one way or another, on tanks; and in doing the best possible for the latter the former will equally improve. River channels have every care and contribute enormously to the general prosperity, but the tanks, not forgetting the small ones, and the wells so intimately allied with them, are the very life of the people, and what relief they give in bad times is at the people's doors.

Colonel Grant.

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Oral Evidence.

1. Q. (*The President*).—You have been for many years connected with Mysore?—Yes, since 1863.

2. Q. No doubt you have seen many changes in the Province since then?—Yes, great changes.

3. Q. Looking back to the dark days of famine, is the country in a better position than then do you think?—Yes, owing to the extension of railways, improved irrigation and general advance.

4. Q. You say in paragraph 4, "the suitability or otherwise of the soil to irrigation is a question of enormous importance. The question turns entirely upon black-cotton soil." That is exactly our experience wherever we have been, this question is most important, do you differentiate between black-cotton soils?—I think it would depend chiefly on the locality and the inclination of the people. I know of many cases in which black-cotton soil is irrigated fairly successfully. I am told that when crops are grown on it the grain becomes coarser and the straw improves, the fact is that people are unwilling to attempt irrigation on black soil, not so much because they think it cannot be irrigated, but because they are disinclined to attempt a new mode of irrigation. I think it depends on the locality in which the black soil is situated and the agricultural skill and inclination of the people. If there were black soil in the east of Mysore there is no doubt that it would be taken up; if you offered it in the centre of Mysore where the population is not so great and dry cultivation is sufficient people would not willingly come forward and take it up.

5. Q. They would be content with their dry cultivation?—Yes, if the population is not very large; if the population is large they would undoubtedly take it up.

6. Q. Would they grow and irrigate dry crops upon it?—I think the utmost they would do in the parts where black soil is found would be to attempt to save their crops; I doubt if they would undertake wet cultivation, that is, rice and sugarcane.

7. Q. (*Mr. Ibbetson*).—Are you speaking of the Mysore district?—In the central parts of Mysore.

8. Q. (*The President*).—In the other part?—I think they would take it up in well populated parts.

9. Q. Would it be mainly rice? Rice and sugarcane. In the extreme east of Mysore people are very skilful wet cultivators; I believe they would take up any irrigation that offered; in the central parts where the population is not great, dry cultivation suffices. In Tumkoor they will not come forward and undertake irrigation, that is my experience.

10. Q. We have found the answer given in many places that if black soil is not very deep, and if there is *murum* below it, they would irrigate, but if there is a deep stratum of black soil they would not? I think almost all soil changes its character under irrigation, a mixture even a little below the surface would be an advantage, there is not the slightest doubt that if black soil were taken up for irrigation it would change its character after four or five years, silt and other soil would be introduced, it would improve though it would take time—that is what I am told.

11. Q. We have been given to understand that irrigation of black soil would only be resorted to under pressure in a year of drought for dry crops, and it is only then that the rayat would take water, what do you think?—I think so. There has never been anything done in Mysore to show what the people would do, they have been unwilling to undertake an experiment and we have no means of knowing what they would do.

12. Q. As far as I remember of Mysore they prefer growing their own food, such as ragi and cholam to rice?—Yes, ragi, and jowar in certain parts.

13. Q. In the famine days people preferred ragi to rice in the famine relief camps?—Yes.

14. Q. You allude to the many natural springs; where are these springs found?—If you take a line from Kortagiri east of Tumkoor, and proceed northwards towards Mulkulmuru taluk, it is along that line that the channels are found; there are a great many rocky hills very conducive to the existence of these channels and they are of great advantage to the country.

15. Q. The springs discharge enough water to make it worthwhile to make the channels?—Yes, they carry their channels a long way.

16. Q. Have they natural channels?—They have to make the channels.

17. Q. (*Mr. Nicholson*).—Would they irrigate up to 50 acres?—I should say they would in some cases.

18. Q. Where the supply is good?—Yes, that would be a large area.

19. Q. Usually it is only a few acres?—Yes, still sometimes up to 50 acres.

20. Q. (*The President*).—You say in paragraph 6, "these eastern rayats are the men who should be encouraged by grant of loans and assistance generally. They are the most industrious of all our rayats, and would repay what was lent them." With what object are these loans given?—For wells chiefly—I am alluding more particularly to the rules which have very recently been framed under section 194 of the Land Revenue Act.

21. Q. That applies to Mysore?—Yes.

22. Q. Are they readily availed of?—I don't think the rules have been working sufficiently long for us to know; during the famine efforts were made to get the people to sink wells, that is not a time at which they are prepared to do anything—it is a mistake in my opinion to try to push the people to borrow money; let them come forward of their own accord.

23. Q. (*Mr. Ibbetson*).—Are these rules for Government advances?—Yes.

24. Q. Had they not been made before?—They were very recently made.

25. Q. Had no advances been made previously?—Yes, during the famine, Mysore has always been very liberal in the matter of advances.

26. Q. (*Mr. Muir-Mackenzie*).—Were they made only in the famine?—No, there are rules existing for the grant of loans for many objects; they have not been embodied in any rules under the Code.

27. Q. In executive orders?—Yes.

28. Q. (*Mr. Nicholson*).—The agricultural banks scheme is one method of advancing takavi to groups of rayats?—I believe so.

29. Q. A great deal has been given by that means, has there not?—I am not in a position to give a positive answer on that point.

30. Q. (*The President*).—Is there much dissatisfaction with the state of the tanks not being kept up to the mark?—Yes, there is a great deal of trouble in that respect, I allude chiefly to the minor tanks—there are 40,000 tanks in this Province; minor tanks are of very great importance to the people, there is always difficulty in getting them to take their share in keeping them in order; so far as I know the *rayats* will never let a tank breach, should there be danger of a breach they at once repair it, but instead of good work being done there is always makeshift work, which is, I imagine, unsafe; they are most reluctant to have anything to do with the ordinary maintenance, though they are aware of the advantage of these tanks.

31. Q. Is there a feeling that Government should do it?—They are always desirous that Government should do it and ask that Government should do it.

32. Q. In Bombay there is a feeling among the people that if they pay wet assessment then Government should keep the tank in order?—I do not think they quite understand that question, I am talking of the ordinary rayat.

33. Q. You say in paragraph 11, "salt efflorescence, 'upalwat' or water-logging, the presence of any deteriorating quality or defect in the soil, are when met with, duly allowed for at time of classification and the rate reduced accordingly. Water-logging is not very common, the remedy is drainage." Is drainage being practised?—Drainage must be carried out in sugarcane cultivation, plantain gardens and betel-nut gardens.

34. Q. Has the necessity been found for making regular deep drainage channels to carry off the water from irrigation?—I am aware of no such work on a large scale.

35. Q. Do you know instances where salt efflorescence has come out and been washed away?—No.

36. Q. (*Mr. Muir-Mackenzie*).—Is any drainage done by Government?—I am not aware of any.

37. Q. (*Mr. Nicholson*).—The configuration of the country lends itself to natural drainage?—Yes, there is more or less drainage in all garden cultivation.

38. Q. (*The President*).—As years go by and tanks silt up and sites become less easy to get, I suppose one must look for extension of wells as the real thing to fall back upon?—Certainly I think so, but in my experience wells follow the tanks.

39. Q. If there was no tank there would be no well?—In very many cases, no tank no well.

40. Q. The whole spring level is raised by the tank?—I think so; there are a great many tanks in these Provinces which are never used for irrigation, there are no sluices, there are gardens below them and water is only used by percolation, they are exceedingly valuable to the gardens below them.

41. Q. Are the tanks of any size?—Yes, they are comparatively large.

42. Q. Capable of irrigating 50 or 60 acres?—The ground below is occupied by cocoanuts chiefly; I might instance one locality where that exists near Budihal, south-west of Chitaldrug.

43. Q. (*Mr. Ibbetson*).—Is the benefit that the garden derives merely from the natural percolation or is a well sunk?—The object is to get the percolation, in every case a well is sunk, a tank is really of benefit to the garden through the well.

44. Q. (*The President*).—Under the circumstances the well need not be a very deep one?—No, as a rule where wells are dependent on tanks water is comparatively near the surface.

45. Q. Is the picottah enough?—Yes.

46. Q. Are these wells generally *pakka*?—No.

47. Q. Merely holes?—Very often; as a rule the more a well is dependent for its existence on a tank, the more easy is the sinking of the well and the cheaper is the well.

48. Q. It is not worth while to make an elaborate masonry structure?—They don't do it—very often so cheap is the well that they shift its position.

49. Q. (*Mr. Ibbetson*).—Why?—Because, supposing a man has 4 to 5 acres in any part of which a well can be sunk, one well would scarcely be sufficient to let him cultivate easily, therefore he makes two or three, were they expensive wells he would not undertake so much.

50. Q. (*The President*).—I suppose you count on getting water within 8 to 10 feet?—Much less.

51. Q. Your well is a matter of a few rupees?—Yes.

52. Q. (*Mr. Muir-Mackenzie*).—Is water so near the surface even in the case of tanks that have silted up?—Undoubtedly, the silting up of the tank does not affect the water level.

53. Q. Even when the tank has gone so far as to be useless for irrigation?—The tank is still beneficial to the well.

54. Q. (*The President*).—You say in paragraph 37—"a well irrigating only one acre when it was capable of irrigating 3 or 4 acres would have a comparatively high rate on that one acre. Conversely a well irrigating to its full capacity, the rate would be comparatively low." Is the rate liable to be changed from year to year?—No.

55. Q. Would a man irrigating one acre with a well capable of irrigating 3 or 4, go on from year to year irrigating only one. How is the rate fixed?—The rate is fixed per acre although practically worked out upon the well, supposing a man exceeds that area it is recorded and nothing more will be charged.

56. Q. Or if he diminishes it nothing will be reduced?—No.

57. Q. Has any mechanical improvement ever been introduced as regards water-lifting apparatus?—I have not seen any.

58. Q. Do they use a leather bag with a spout?—On certain wells.

59. Q. With a hose at the lower end?—I have not seen the hose.

60. Q. You say "a year of scarcity if severe is not a time when people care to engage in constructing wells." In some places the famine of the last few years has given a tremendous impetus to the taking of loans for constructing wells?—I believe that the number of wells sunk during the famine in Mysore was not great.

61. Q. You say towards the end of your paper "as bearing upon the question of irrigation so far as it can be affected by the revenue demand I may mention that the Government of Mysore has most wisely, indeed necessarily, sanctioned an entire reclassification of the water-supply to all irrigable lands. This reclassification is completed in about six taluks and will be incorporated in the revision settlement." That reclassification will take a long time?—Yes, the reclassification will have to proceed, excepting in these six taluks, immediately after the resurvey.

62. Q. Is there a settlement going on now in the taluks?—It is just commencing, I am about to submit proposals in the matter for the first two taluks.

63. Q. You say at the end of your note, "I would say that the true policy for the Mysore Government to adopt in view of the contingency of bad seasons is a thorough repair of tanks, large and small." Would you make them over to the Public Works Department to do?—I believe the Public Works Department are very much opposed to that being done, I don't suggest the means, however the end is attained; the repair of these tanks is most important because the wells depend upon them.

64. Q. Of course you remember Sir Richard Sankey's scheme. At the end of the famine we came to the conclusion that it was too costly to continue: I think his argument was that we should begin at the smallest and make every unit complete in itself. It was held that however valuable this might be it was prohibitive in point of cost after the heavy losses of the famine. I don't know what has been done since?—(No answer.)

65. Q. (*Mr. Higham*).—You said if black-cotton soil was converted into wet land it would take several years before good crops were obtained—when that is the case and good crops are obtained, do you think that the profits of cultivation are such as to make it worth while to give up dry cultivation? What are the profits of cultivation on irrigated black soil as compared with the profits of dry cultivation?—I don't think the profits on irrigated black soil are greater than on red—I don't think there is anything very exceptional about black soil.

66. Q. That would in itself be a reason why people are not anxious to take to irrigation?—I don't think the people know what would happen if they irrigated black-cotton soil, they are afraid to undertake it, it is something new.

67. Q. In cases where they have taken to it and wet cultivation has been introduced, could you say that they are better off than when they irrigated dry crops?—I think they would be better off. In Yelandur and other parts I have seen very good black soil and very good wet crops. That bears out what I say that it more largely depends on the locality and temper and inclination of the people than on almost anything else.

68. Q. (*The President*).—And the density of the population?—Yes.

69. Q. (*Mr. Higham*).—Are the holdings very large?—In the eastern parts of Mysore the holdings are very large—it is practically virgin soil, they plough it up thoroughly once and then don't plough it for 12 or 15 years, they pull the crops up by the roots, pass a harrow over it and the soil is ready again.

70. Q. That rather affects the question, does it not; even supposing that a man might get a great deal more out of one acre of wet cultivation than out of one acre of dry, the comparison should be made not between one acre of wet and one acre of dry but between one of wet and two or three of dry?—Quite so.

71. Q. They would not convert the cultivation into wet except under great pressure of population?—I think so.

72. Q. And sub-division of holdings?—Yes, and the introduction of more skilful cultivators who know what wet cultivation is.

73. Q. I have heard of two tanks in Mysore that are in black-cotton soil, one is a very ancient tank, 200 to 300 years old, the Sulekere, do the people irrigate from that tank?—Attempts to induce people to come and irrigate under the Sulekeri tanks have been practically a failure, land was offered on very favourable terms but the inducement has not been found sufficient, although the rates are certainly not high; it is not very healthy under the tank and as a matter of fact the cultivators have not come forward.

74. Q. May that be taken as a typical instance of the unwillingness of the cultivators to cultivate black soil?—Yes.

75. Q. (*Mr. Muir-Mackenzie*).—Is cotton grown in the soil commanded by the tank?—No.

76. Q. (*Mr. Higham*).—Another tank is of more recent construction—the Kumbakatti is that a failure too?—Yes, that is a failure for the same reason that the people are disinclined to come forward.

77. Q. (*Mr. Ibbetson*).—I believe that the famine of 1876 is the only one on record as having happened here?—There was great scarcity in 1866.

78. Q. Since 1876?—There has been nothing that I should call severe.

79. Q. Not even severe scarcity?—No.

80. Q. You have said that the Province is better protected against famine now than it was in 1877, setting aside railways and the general development of the country, in what degree do you think it is now better protected than it was, has the irrigated area been extended?—By the extension of irrigation more than anything else, without reference to any change in the mode of irrigation.

81. Q. Has the extension been great?—There has been a great extension in the channels from rivers; there have been a good many tanks made.

82. Q. And wells?—Some wells have been undoubtedly sunk.

83. Q. Have these channels from rivers been made by Government or by the people?—By the Government, they are more extensions than new works, extensions to existing channels.

84. Q. Take the new tanks, I suppose capital and revenue accounts are kept for them?—Undoubtedly.

85. Q. How far have they paid Government by direct return?—I believe before any tank is undertaken it is ascertained that the return shall be, at any rate, adequate, I have nothing to do with that, I think the Public Works Department could give the information.

86. Q. How far is there room for further extensions in irrigation from channels?—As regards what are called river channels, almost all we have are led from the Cauvery and Hamawattee. (Addressing President.) In 1878 when you were here as Officiating Chief Engineer you questioned the amount of concealment in river channels, the area was put at 47,000 acres and that area was supposed to be irrigated, my department then took up the work and the figures now are 73,000.

87. Q. I mean is there any room for further expansion?—I think that must be gauged from the area irrigated, which is 73,000 acres.

88. Q. Do you think the 73,000 can be increased?—I think so.

89. Q. (*The President*).—Do you mean that since 1878 channel irrigation has extended from 47,000 to 73,000?—The 47,000 acres have been ascertained to be really 73,000, the increase is chiefly due to concealments, 50 per cent. excess has been discovered and the profit of course has been very great.

90. Q. (*Mr. Muir-Mackenzie*).—No great extension of actual cultivation has been made apparently?—There has been a good deal, undoubtedly there has been extension of channels.

91. Q. (*Mr. Ibbetson*).—Do you think a further substantial extension is possible?—Not a very large amount; a moderate amount.

92. Q. As regards tanks, is there room for extension there?—I should say there is less room, because every available spot has been taken up, anybody looking at a typographical map for sites for tanks to find out where he could make them, would find himself forestalled everywhere.

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93. Q. Is there a large proportion of tanks silted up so as to be practically of no use for irrigation?—No doubt a large number are silted up and a good many are not used for irrigation.

94. Q. What I wanted to know was how fast the process of silting up is going on?—I cannot say.

95. Q. You have not derived any idea of the life of a tank from what you have seen?—No, I have not attempted to form an opinion.

96. Q. When your tanks are silted up you say there are no more sites available?—There must be very few.

97. Q. The reason that you cannot expand being not that the water is all used up, but that there are no unoccupied sites?—Yes

98. Q. You said there are parts where black soil is irrigated successfully; what is the depth of the soil in those parts?—I should say it was very deep.

99. Q That is to say more than 3 feet?—Certainly.

100. Q What do they grow there?—Rice, sugarcane, wheat and onions, garden crops generally.

101. Q. Is it what you would call high class black soil?—There are gradations, I should call it high class; black soil for garden crops is more workable than when used for rice.

102 Q. Why?—They can divide the land to be irrigated into little plots which are more under command, it would be impossible to flood a large extent of black soil, whereas little divided compartments could easily be manipulated—for this reason black soil is more favourable for garden cultivation than for rice.

103 Q You spoke of the extreme reluctance on the part of the ryots to attempt the experiment of irrigation on black soil—has such irrigation extended at all while you have been in the Province?—I am not aware of it

104 Q You don't know a place where they used not to irrigate when you came here, but where they have taken it up since?—I don't know of any black soil being taken up for irrigation on a large scale.

105. Q. (*Mr. Muir-Mackenzie*) —Do you know of other classes of soil being taken up?—Yes

106 Q. (*Mr Ibbetson*) What is the rule with regard to enhancement of assessment where a man who is paying dry assessment makes a tank? The course is this—his land is assessed at a water-rate of Rs. 4, but in consideration of having constructed a tank and maintaining this tank one-fourth is remitted, he is not liable to enhancement except in so far as the full rate may be altered or reduced.

107 Q You say that three-fourths of the wells in the Province are directly or indirectly dependent on tanks, does that mean that the areas where wells can be made apart from tanks are limited? I think myself that tanks are a great deal older than wells wells are sunk below the tank.

108 Q Supposing you have a tank from which you have channels and can irrigate the land, and under that tank there are a number of wells using the under-ground storage. Your channels enable you to distribute the above ground storage: do you in order to avoid using two sources of supply on the same land carry the direct irrigation from the tank beyond the wells and supply it to land on which there is no well, or do you give the direct supply to the same land that the wells are already made in?—As a rule it will be found that where wells exist they don't use the water from the tank, in that case the water passes to what we call wet land.

109 Q That is the rule?—Yes, now and again we find that a man uses both supplies but that is not usual.

110 Q. Do you do anything to prevent him using both sources of supply so as to economise the water?—Sometimes a man has got a piece of land situated under a tank in which he has a well to which tank water can also be given, that man, during the currency of the settlement, says I want tank water too, in that case enquiries would be made, whether, looking at the requirements of the others, he can receive the water. Very often it is decided he must go on cultivating without it.

111. Q You would give the preference to a man without a well?—Yes, as a rule.

112. Q. (*Mr. Higham*).—Are wells ever abandoned for tank water?—Very rarely.

113. Q. What is the reason?—Because he prefers his well water to any other water, he likes his own supply which cannot be interfered with. He would prefer a small tank to a big one.

114. Q. (*Mr. Muir-Mackenzie*).—Which assessment is higher?—*Bagait* is higher, because Government have always claimed their share of what is called superior produce.

115. Q. (*Mr. Ibbetson*).—Supposing you had half a lakh of rupees to build wells with, how do you think you would do most good to the people and protect them effectually, by building these wells in dry lands where they have no means of irrigation or sinking them under tanks where they already have water available?—The tanks have taken up all the good sites, it is very improbable that you would find any good sites for wells.

116. Q. There are hardly any places where wells could be sunk with advantage?—I think there is very little suitable ground left for sinking wells.

117. Q. Do the villagers regulate the distribution of water from tanks themselves?—It is done by the *nirganti*.

118. Q. Are there many disputes?—I have heard of very few.

119. Q. I have heard elsewhere that if a tank does not fill up so that the supply will not be enough for the land which requires water, the people will not use any of the water because they cannot decide who is to use what there is?—I have not heard of such a case.

120. Q. Do you doubt if that is the case?—It is not in my experience.

121. Q. I understand that your revenue on wet land is a consolidated revenue, paid whether they take water or not?—Yes.

122. Q. Even if a tank is empty they will pay their regular assessment?—Yes.

123. Q. You say it is most difficult to get people to do the petty repairs of their tanks; is there any sort of penalty which can be imposed, making a man pay double the value of the labour, or anything of that sort—is there any law to that effect?—I am not aware what power Government has, it is laid down in the old standing custom of the country.

124. Q. Who has charge of that work, the Public Works Department or the Revenue authorities?—I think it is a dual management. I have nothing to do with it.

125. Q. With regard to advances, Government advances were common enough before the introduction of the new rules?—Yes, I think the rules were framed more because the code laid down that certain rules should be framed; advances were made before under working rules.

126. Q. Do you know anything about them or their working?—I have had nothing to do with them.

127. Q. Have you heard people talking about the terms on which Government money is advanced; do you know any points on which they complain?—I have heard no complaints.

128. Q. You say new wells diminish the supply of old ones?—In making that remark I had in view some independent wells, not tank-fed wells.

129. Q. Can you give any idea of how near it is safe to build wells to one another without risk of their interfering with one another's supply. How many wells could you put into 50 acres for instance?—It would depend entirely on the water stratum, in wells under tanks there might be any number, where wells are dependent on springs you could not exceed one well for 5 or 6 acres, otherwise there would be danger of their robbing one another.

130. Q. Is there any system in Mysore of giving a man who constructs a new irrigation work an inam, say one-tenth share of the returns of his holding?—There used to be a one-fifth share allowed or *panch-hissa*—now it has been changed to one-fourth remission.

131. Q. Were there many works constructed under that old *panch-hissa* rule?—There were a great many.

132. Q. What was it exactly?—A man got off one-fifth of the whole assessment.

133. Q. Have you ever heard the abolition of the old *panch-hissa* rule regretted?—No.

134. Q. I understand the old *panch-hissa* rule was a share of the returns from his holding?—I cannot say for certain, I think it was in the same nature as the present rule.

135. Q. We have been told that the wet lands under tanks are mainly held by the richer and non-agricultural classes and that the poorer cultivators will not take them up because they are afraid of the risk of bad years, is that your experience?—It is my experience entirely with reference to the channel lands which are altogether in the hands of capitalists; it would not apply to tanks.

136. Q. How did they come into the hands of capitalists?—I think in many cases they were acquired by Brahmins who watched their opportunity of getting them.

137. Q. Are the channel lands particularly valuable?—Very valuable.

138. Q. Do you think that applies to channel lands only?—Yes.

130. Q. (*Mr. Muir-Mackenzie*).—You say that there are no lands more prized than well-irrigated lands and yet I understand that the rate on well lands is higher than the rate on rice lands?—I don't think the rate is higher for the reason I explained; the acreage rate may appear higher, but it is really not higher.

140. Q. I understood you to say that it was the custom of the State to take a share of the more valuable produce and that that made the assessment higher?—I was alluding chiefly to the betel-nut gardens on which the rates are very high, simply because the Government have always had their share of the superior produce; and not only that but the export duty is 25 per cent. higher than the land assessment.

141. Q. Still I imagine it is true of these lands as of other well irrigated lands that no lands are more highly prized?—Yes.

142. Q. And on no lands is the assessment more easily paid?—Yes.

143. Q. In a year of famine is it the case, as in 1876, that the great majority of the tanks would be empty?—Yes, I think so.

144. Q. I don't understand how, except in the mere matter of river channels, the country is better protected now than it was then by the extension of irrigation?—It is only protected by increased crops. Apart from land under channels I don't think I could say there has been any very great change.

145. Q. But even the new tanks would be empty, would they not?—Yes, that is likely.

146. Q. I mean in time of famine would the protection be any greater than it was in 1876-77?—Only by increased produce under channels.

147. Q. (*The President*).—I suppose there would be some increase under wells?—No doubt.

148. Q. (*Mr. Muir-Mackenzie*).—Now as regards the silting up of tanks and its being impossible to use them for irrigation, would you say there are fewer tanks in effective operation now than when you came here?—No, taking the condition of the tanks and everything into account they are about the same, some have deteriorated and some have improved.

149. Q. The water-supply would have improved in some places and deteriorated in others?—Yes.

150. Q. You say six taluks have been resettled?—Yes.

151. Q. What has been the result: has it shown a general improvement on the average?—I kept the water classification which was sanctioned by the Mysore Government in abeyance so that I make use of it, although it was carried out some years ago. I am not able to tell you the result.

152. Q. Not even in two taluks?—I don't see very much change.

153. Q. (*Mr. Ibbetson*).—By "change" you mean extension of irrigated area?—Yes, I don't think there is an increase.

154. Q. Is it the case that although the irrigated area has not been extended the supply has become so certain that you could put on a higher assessment?—I don't think so.

155. Q. (*Mr. Muir-Mackenzie*).—You are convinced that it is advisable to go on with the revised classification?—I think it is absolutely necessary in the interests of Government and of the ryat.

156. Q. I am anxious to get at a clear idea of whether the black soil in Yelandur, which yields very good wet crops, is true black-cotton soil?—Yes.

157. Q. Has it deep cracks?—Most of the black soil is under irrigation, I cannot say I have noticed particularly whether these cracks remain. I cannot speak positively.

158. Q. Is it very deep?—I should say so.

159. Q. Does black soil when under irrigation take more water than the other soil?—I am unable to say. I should think it would take a great deal more water.

160. Q. You allude to the practice in several taluks of Chitaldrug of running up embankments in favourable spots, not to hold water, but to collect silt and soil. Were there many of these made in the great famine?—Yes, they have been there from time immemorial.

161. Q. Did the lands behind them yield crops?—Yes, certainly, I think some crops were to be found there when they could not be found anywhere else.

162. Q. Could famine relief labour be profitably employed in making more of these embankments?—No, because the initiative is invariably taken by the occupant of the soil himself. I don't think you could find out where they could be advantageously constructed.

163. Q. Not by a survey?—No, I don't think so.

164. Q. Still advances might be given liberally?—There are very few sites left, they are very valuable.

165. Q. I understand no remissions are given on account of failure of water in the tanks?—No, because the assessment was based on an average; cases in which a remission is given is *where the tank breaches.*

166. Q. Are you satisfied with the working of that system?—Yes, if judged by results and by watching the working of the settlement since it was introduced, I don't think the system is a bad one.

167. Q. You don't think the ryats have had difficulty in paying their assessment in bad years?—The only way one could judge is by the land under occupancy, it has not gone back.

168. Q. Has the land under occupancy increased?—Yes, I think it has increased.

169. Q. (*Mr. Rajaratna Mdlr.*).—Do you mean the irrigated area?—Yes.

170. Q. (*Mr. Muir-Mackenzie*).—Will you kindly indicate some particulars regarding the more liberal policy you spoke of in the matter of well-irrigated land?—The general idea in respect of wells which were in existence at the original settlement thirty years ago and which have been assessed is to reduce that assessment to the highest dry crop rate, the same as in Bombay, except that I think nothing quixotic will be done, a great difference will be made between places where the water is far away and those where it is near the surface, it would be madness to treat them alike, and I think it would be quixotic on the part of Government. In Bombay their policy went far beyond their pledges, they said that no improvements made during the currency of the settlement should be taxed during the settlement, but they said nothing about lands that were in existence at the time of the settlement, they took up the first taluk and started a policy which went far beyond their own terms, they reduced the assessment which was in existence at the first settlement to the highest dry crop rate and wells which were made during the currency of the settlement they assessed at simply dry rates; then on a well under the ayacut of a tank they said we will take double the highest dry crop rate, that would mean taking a great deal, there is no limit if this is done. I don't think this Government will ever strictly follow the Bombay principle.

171. Q. You don't think they will go as far as Bombay?—They will be more liberal, certainly they won't ignore wells which are dependent on tanks and Government works, they must impose a different system there.

172. Q. (*Mr. Rajaratna Mdlr.*).—You say that in the case of wells in wet lands the assessment is double the ordinary dry rate?—No.

173. Q. Is it proposed to do that?—No revision has yet been carried out.

174. Q. Is it proposed to adopt that policy of charging double rates for wells in wet lands?—I think not. I merely mentioned it by way of illustration, nothing has been settled in Mysore.

175. Q. What has been the increase in irrigated area under tanks, do you happen to know?—I said I thought there had been an increase in the irrigated area under tanks, but I could not give you figures.

176. Q. Could you say roughly what is the percentage?—I believe there has certainly been an increase. I am unable to give figures.

177. Q. Was it due to the construction of new tanks or the repair of old ones?—I have no accurate information.

178. Q. Can you say for certain there has been an increase?—Certainly.

179. Q. Notwithstanding the fact that no attention was paid to the repair of minor tanks?—Yes, there has been an increase.

180. Q. During the past 30 years do you know whether much has been spent on the repair of these minor tanks?—I know a good deal has been spent, I think if you enquired from the Public Works Department you would find that that is so.

181. Q. On large projects enormous sums have been spent but not on minor projects?—I don't know, I could not give you accurate information.

182. Q. Does your assessment include one anna in the rupee as an irrigation cess?—Yes, one-seventeenth of the assessment is deducted and credited to the Irrigation Fund, that is merely on paper just now, it was manipulated by Government as an Irrigation Fund.

183. Q. Is it assigned to each village or group of tanks?—No, it is not assigned minutely in that way; it is taken into a general fund and manipulated.

184. Q. It is not set apart for expenditure on particular works?—No.

185. Q. Can you say roughly what is the average wet rate under tank irrigation, taking all the tanks together?—The average would be Rs. 3-8-0 roughly:—A high class tank would be Rs. 5 or Rs. 6, and it would go down to Rs. 2.

186. Q. Are there not villages in Mysore situated close to British territory in Cuddapah?—Mysore territory is adjacent to several villages in Cuddapah. I don't know the exact part you allude to.

187. Q. I remember several villages in which your rates are higher?—Possibly.

188. Q. And in British villages remission is given though not in Mysore. On what grounds is remission not given?—Because the capability of the tank has been taken upon the average of a number of years.

189. Q. In what way have you allowed for vicissitudes of seasons in fixing rates?—On a tank which has filled once in two or three years we have put a very low assessment.

190. Q. You take the old assessment and reduce the rates?—Perhaps reduce or raise.

191. Q. In the taluks you have settled, have you reduced the old assessment?—Yes.

192. Q. To what extent?—I cannot say in detail, if you were to take 300 villages, you would probably find 50 to 60 reduced.

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193. Q. Was that done owing to the policy of lenient settlement or with reference to the precariousness of the supply?—Having regard to all the circumstances of the country and also looking at the past revenue and collection, in a great many villages it was probably raised, but in a considerable number it was reduced.

194. Q. Has there been any re-settlement since the original settlement?—No.

195. Q. Is any contribution levied from cultivators under tanks in order to carry out repairs to such tanks?—There is only the irrigation cess.

196. Q. As regards smaller works, is the repair left to the cultivators themselves or does Government carry out the repairs?—I believe in the case of minor tanks, the ryots are supposed to keep them under repair.

197. Q. What is the limit?—I think it is judged by the revenue. If the revenue is less than Rs. 300 it is considered a minor tank.

198. Q. Have all such tanks been repaired and handed over to the rayat?—No.

199. Q. In such a case is the irrigation cess remitted?—It is included in the assessment and is certainly not remitted.

200. Q. Although the rayats are called upon to keep them in order?—No, not even in consideration of that.

201. Q. You said that when there is a well in an *ayacut* you don't allow the rayats the use of the tank water?—We allow him to use it if at the time of classification he was using it. When we did our classification we assumed that that man always cultivated his garden by the aid of his well, but Government would take the existing state of things into consideration and fix the assessment; if a man said I wish to use my well and also the channels, it would be a moot question whether the authorities would allow it.

202. Q. Supposing he was using the water at the time of the settlement how would you classify his land, as wet, or garden?—As garden. We classify it upon the existing state of things.

203. Q. Supposing he did use the tank water in addition to his own well, would you impose anything extra?—I suppose it would be reported and some order passed upon it.

204. Q. What is there to prevent him using this water?—No doubt it would be brought before the officer for orders and he could be fined, of course, but I imagine he probably would not be, some arrangement would be made about letting him have the water and changing the assessment.

205. Q. You said the assessment on garden land is fixed on the well not on the area?—I meant to say that it is recorded as so much per acre, but there is no doubt that the area under a well pretty well regulates the total amount you put on the well; it is more as if you put an assessment on the well for what it could irrigate.

206. Q. In the settlement you assess so many acres as irrigable by a well and the rate is fixed on that?—There is no fixed mode of dealing with it in that way; the rates may seem very high, but they are really not very high.

207. Q. You say that the rate varies from Re. 1 to Rs. 8; does it go as low as Re. 1?—Yes, in Chitaldroog we constantly place Re. 1 per acre on well irrigated land.

208. Q. Garden land?—It is only called garden land because it is under a well, the rate is fixed actually by the settlement officer.

209. Q. What is the highest rate per acre on each garden?—In the betel-nut gardens it goes as high as 16 or 18, that is quite special produce; before our settlement was introduced it used to be 40.

210. Q. Now it seldom exceeds 16 or 18?—Yes.

211. Q. Do you charge on the crop; supposing a betel-nut garden is destroyed and other crops are raised, do you reduce the assessment?—No doubt a change would be made.

212. Q. Before the expiration of the settlement?—If a case occurred no doubt it would be taken up; in one taluk which was completely reclassed there was scarcely any change whatever, the gardens were just the same as they were thirty years ago; the changes are ridiculously small.

213. Q. But if a change did occur you would take that into consideration?—No doubt.

Witness No. 35—M.R.Ry. K. P. Puttanna Chetti, Deputy Commissioner, Shimoga District.

M.R.Ry. Puttanna Chetti.

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Written Evidence.

[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. The answers below refer to the Shimoga District. As Deputy Commissioner of that district, I have seen all parts of the district and acquainted myself with questions relating to water-supply.

2. The average rainfall is given below:—

Year.	Jan.	Feb	March.	April.	May.	June.
1897 ..	..	0·02	..	1·21	2·50	13·84
1898 ..	..	0·07	0·21	2·66	2·47	12·63
1899 ..	..	..	0·26	4·74	1·80	13·39
1900 ..	0·01	..	0·06	1·88	1·01	18·25
1901 ..	0·02	0·43	0·17	1·84	2·70	6·96

Year.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897 ..	18·53	14·57	6·14	3·67	0·02	.. ..
1898 ..	17·57	6·95	11·5	8·39	4·33	0·04
1899 ..	5·17	3·75	4·94	4·74	0·33	..
1900 ..	24·96	16·21	4·12	3·61	0·69	..
1901 ..	23·02	10·9	3·31	6·81	1·24	..

3. (1) According to the latest census returns the population in the Malnad parts of the district has, far from showing any increase, shown a diminution over the figures of the previous census. Population is scanty in the Malnad parts, and consequently much wet and garden land remains uncultivated. Labour for the supari gardens and wet cultivation generally has to be imported from the South Canara District. The sparsity of population is therefore one of the chief obstacles to the extension of irrigation, for which some facilities exist in the Malnad tracts.

The Maidan talukas are more populous and the above remarks do not apply to them.

(2) The heavy rains in the Malnad are not favourable to the longevity of ploughing cattle (buffaloes, bullocks, etc.), which generally die in a much shorter time than in the Maidan. The replacing of these cattle is a heavy item of cost, and operates prejudicially on the extension of irrigation.

(3) Supply of cattle being limited, manure is not so abundant as in the Maidan parts.

(4) The greater portion of the district contains red soil often mixed with sand. Black-cotton soil is found in portions of Honnali, Channagiri and Shimoga Taluks.

(5) No such uncertainty or irregularity exists. The South-west Monsoon as a rule never fails. The North-east is sometimes late in appearing and cannot always be depended upon.

(6) In most cases the lands are sublet to tenants, the landowner getting his rent in cash or in kind. In the Maidan parts such lands are not made to yield a fair return; as the cultivating rayat prefers his own dry land and takes up the wet land on lease as an additional source of income. As the income from the land thus gets distributed, there is not sufficient capital for the more expensive cultivation of irrigated crops.

(7) No such fear exists.

(8) There is no uncertainty as to tenure, nor any defects in the Tenancy Law.

4. The period is not fixed. The Survey and Settlement Department fixes the reduced assessment, which is thereafter levied regularly from year to year. No option is left to local officers in the matter. The existing concession appears to be liberal enough.

5. The provisions of the Land Improvement Act do not seem to have been fully availed of for the extension of irrigation. The rayats do not like the cumbrous procedure involved in the getting of a loan, nor do they appreciate the cast-iron rigidity with which payments are enforced without regard to their private circumstances. I would recommend that powers may be given to District Officers to reduce the rate of interest, and to extend the time of repayment, where necessary. In extreme cases total remission may be granted in cases of failure of the best attempts to obtain water.

6. The rayats as a rule prefer dry crops, and there is no likelihood of dry lands being thrown out of cultivation by the

extension of irrigation. In the Maidan taluks the rayats are desirous of augmenting the water-supply so as to convert their dry lands into wet.

B.—Canals of Continuous Flow.

No such canals exist in this district.

C.—Canals of Intermittent Flow.

12. (1) The Shimoga District has two canals which contain water only in some months of the year. They are (1) Sulur anicut and channels in the Shikarpur Taluk, and (2) Sogil anicut and channels in the Honnali Taluk.

Both these are dams across minor jungle streams, and the water stored up in the anicut is utilized for irrigation by means of earthen channels.

(2) Water is distributed for irrigation by subsidiary channels taken from sluices of the main channel, the size of the sluices varying according to the extent to be irrigated by them. A few tanks which exist along the course of the channels are also fed by them.

(3) (*a*) In a year of ample rainfall the channels contain water for about four months.

(*b*) and (*c*) They will contain little or no water either in a year of scanty rainfall or in a year of drought.

13. (1) There are no such possibilities in the Shimoga District.

(2) Rice land may be cultivated with sugarcane in favoured tracts, and the difference in value will average 40 to 50 per cent. in favour of sugarcane. The same difference exists with regard to garden crops as against rice land.

(3) (*a*) A bumper crop may be expected.

(*b*) A middling crop may be looked for.

(*c*) None in a year of drought.

14. Too late commencement will not admit of the timely sowing of paddy crop. Too early cessation will interfere with the formation of grain and the maturity of the crop.

15. No such cases in this district.

16. (1) The dry crop being taken as the unit, the approximate increase in the produce per acre due to irrigation may be put down as 25 per cent. for rice and from 70 to 100 per cent for sugarcane.

(2) There will be no increase in a year of drought as the stream will run dry.

17. The rate paid annually per acre of wet land on account of irrigation comes to about Rs. 3 on an average. The wet assessment paid to Government includes both this rate and the average dry rate. The similar rate on garden lands is about Rs. 9 per acre. There are no irrigation works constructed by private persons with the object of levying irrigation rates on account of the water-supply created by them.

The wet assessment is generally levied on the full area of the holding, whatever may be the extent on which wet crop is raised.

18. A certain amount of expenditure is necessary to prepare the land for irrigation, which may be put down roughly at Rs. 10 per acre. This is incurred by the landlord and not by the tenant.

19. None has come within my knowledge.

20. Maintenance and clearing of silt is carried out by Government agency. When there is a considerable amount of work to be done, estimates are prepared before the work is put in hand. The annual cost of conservancy establishment is 10 pies per acre for Sogil channel, and 1 anna and 6 pies per acre for Sulur channels.

The system works fairly well.

21. No private channels.

22. There is no scope for such works in the Shimoga District, nor are there capitalists who could undertake them on their own account

D.—Tanks.

23. (1) Tanks in this district are generally rain-fed. In some few cases they are fed by streams.

(2) The distribution of water for irrigation purposes is by means of sluices and channels.

(3) (*a*) In a year of ample rainfall the supply is generally maintained for six or seven months. There are however a few large tanks which do not run dry in ordinary years, the largest tank being the Sulekere in the Channagiri Taluk which when full contains from two to three years' supply.

(*b*) In a year of scanty rainfall the tanks contain little or no water.

(*c*) In a year of drought they contain none at all.

(4) The area ordinarily irrigated by each tank is on an average 24 acres. This is an average for the whole district, the largest area being 2,486 acres and the smallest 10 acres.

24. Please see reply to query No. 13.

25. Please see reply to query No. 14.

26. In the case of gardens under tanks and also wet lands on which sugarcane is grown, tank irrigation is generally supplemented by wells.

27. Please see reply to query No. 16.

28. Please see reply to query No. 17.

29. Please see reply to query No. 18.

30. A special establishment is maintained for the Sulekere tank and channels, the annual cost being about four annas per acre. No other tanks have got any such establishment. The village officials look to the watching of tank and distribution of water; the taluk authorities look after the repairs; earthwork and turfing being attended to by the villagers free of charge, and masonry by the Revenue or Public Works Department.

31. There are only two private tanks in this district, all the lands under them being held by the persons who constructed them. No trouble has arisen in respect of distribution of water.

32. The existing rules make ample provision for this. Further encouragement does not appear to be necessary.

33. The tanks are fast silting up. I have seen many tanks with a very shallow bed. I am unable to give statistics. No attempt is made to remove the silt. The ryots complain bitterly about the diminishing capacity of the tanks and apply for the raising of the level of the waste weir, which means raising the bund and additional masonry work No funds are forthcoming for this work.

E.—Wells.

34 (1) There are no irrigation wells in the Malnad parts. In the Maidan, such wells exist in garden lands. Water is baled by means of *pacotas* and *kapile*. The average depth of the well is about 30 to 40 feet.

(2) These wells are fed generally from springs, and in a few cases also by percolation. In a year of drought the source of water-supply is likely to fail.

(3) A permanent well would cost about Rs. 500.

(4) The duration of a well depends upon its situation, the permanence or otherwise of the water-supply, and the quality of the soil. Old and long established wells hold out longer than new wells.

(5) Water is usually lifted by means of *pacotas* or *kapile*.

(6) The average area commanded by a well is about one acre of land.

(7) Same answer as above.

35. (1) Wells are used as auxiliary to tank irrigation. Two harvests are not raised anywhere in the district.

(2) When tank irrigation fails in hot season, temporary wells are sunk for the irrigation of the sugarcane crop. Garden crop, such as betel-leaf and plantain, is grown under wells in low-lying tracts where water-supply is perennial.

(3) (*a*) In a year of ample rainfall the tanks contain sufficient supply of water and wells are rarely resorted to. Where gardens are entirely dependent upon wells these are of material help in raising the crop.

(*b*) In a year of scanty rainfall wells contribute materially to the irrigation of garden lands. But the scantiness of the rainfall may affect the water-supply in the wells.

(*c*) In a year of drought the wells generally run dry, except in exceptionally favoured localities. The crops below them fail as a matter of course.

36. There is no cultivation entirely dependent upon wells in this district to any appreciable extent.

37. No wells have been constructed at the cost of Government for irrigation purposes.

38. (1) The selection of a spot for sinking a well is often a matter of great difficulty to the ryot. His knowledge of the water-bearing strata has often to be supplemented by the advice of the village astrologer who, by the exercise of his art, is supposed to possess the knack of indicating a place where water is likely to be tapped. A successful man of this sort is in constant requisition in his neighbourhood. Places where ant-hills occur or certain kinds of shrubs grow are said to be peculiarly suitable.

(2) In the actual construction of the well the chief difficulty experienced is the want of funds. Sometimes the wells fall in owing to bad construction or treacherous soil. The Amildars, and the Work and Tank Inspectors attached to taluks, in the course of their itineration, give necessary advice to the parties when they hear of such cases.

39. I am not in favour of Government constructing wells in private lands. The administration of such wells would be attended with much inconvenience and trouble. The better scheme is the present one under which money is advanced to the owner of land by Government for the construction of wells. The maintenance of such wells if built by Government will become a serious question. The smaller tanks have been systematically neglected, and if their restoration and maintenance are taken in hand by the Government instead of being left to the rayat as at present, it would materially help the interests of irrigation.

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40. Temporary wells are commonly used in the district to supplement tank irrigation for raising garden produce and sugarcane crop. This is especially the case in Maidan and semi-Malnad parts. In low-lying tracts such wells afford some protection in times of drought, which is not of a prolonged nature. In times of severe drought they fail entirely. These wells cost but little and can be easily excavated by the ryots without help from Government. Even if such help were needed, the same can be granted under the Takavi Rules recently introduced and the Land Improvement Loans Regulation.

Oral Evidence.

1. Q. (*The President*).—You are Deputy Commissioner of Shimoga?—Yes.

2. Q. Have you been long in that place?—I was there for four years some time ago and lately I have been there ten months.

3. Q. Have you had experience of any other district of Mysore?—Yes, I was for nearly three years in Bangalore and Kolar districts. I was also in Mysore District for a couple of years as Sub-Division Officer of French Rocks.

4. Q. What proportion of your district do you consider to be Maidan and what Malnad?—About two-thirds is Malnad and one-third is Maidan.

5. Q. Even in the Maidan are they liable to be affected?—No.

6. Q. In 1876-77 I don't think the distress in your district was very great?—No, there was no great distress in the district, but people came there from affected parts.

7. Q. You say in paragraph 5, "the provisions of the Land Improvement Act do not seem to have been fully availed of for the extension of irrigation. The ryots do not like the cumbrous procedure involved in the getting of a loan." Is that for making wells?—Yes, and also for improving the land; and for planting and grafting mango trees, etc.

8. Q. What interest is demanded?—5 per cent for land improvement and 3 per cent for wells.

9. Q. What is the period of repayment?—Thirty years in the case of wells and fifteen to thirty in the case of land improvement, according to the amount.

10. Q. How long does it take to comply with applications?—I have seen applications stand over for two years sometimes.

11. Q. You think power should be given to District officers to reduce the rate of interest?—Yes, 5 per cent is rather high; 3 per cent is a low enough rate for wells and as regards 5 per cent, I would give discretion to the District officer to reduce it where necessary to 3 or 4 per cent.

12. Q. You say in paragraph 5, "I would recommend that powers may be given to District officers to reduce the rate of interest and to extend the time of repayment, where necessary." It is thirty years now?—Yes, if there is any difficulty connected with a man's domestic circumstances or any such thing, we must have the power to delay the instalment.

13. Q. Is that power not given to the Deputy Commissioner?—Not at present, we can only write to Government and get sanction in each case.

14. Q. Do you think there would be much extension of wells if there were more facilities given?—Yes.

15. Q. Is there much well irrigation in Shimoga?—Not much, we have got wells for garden lands, these wells are subsidiary to irrigation from tanks.

16. Q. You say in paragraph 20, "maintenance and clearing of silt is carried out by Government Agency." Does the conservancy establishment do that, or the Public Works Department?—If it is ordinary clearing, the conservancy establishment do it; if it is anything extra, it is done at the expense of the State.

17. Q. What happens as regards tanks; do the ryots do the small repairs?—Yes, they maintain all the bunds and the earthwork.

18. Q. Up to what size?—In the case of tanks yielding Rs 300 and above they are restored by the Public Works and Revenue Departments and then the ryots have to maintain them.

19. Q. Below Rs. 300? The ryots do the earthwork and Government does the masonry.

20. Q. If the Deputy Commissioner finds a tank in bad order?—He calls upon the ryots to do the earthwork.

21. Q. Can you legally compel the ryot to take his share of the work?—We have rules that have been a long time in existence in which the ryots recognize their obligation; if they don't, we don't do anything to the tank.

22. Q. I see in the statement that has been furnished to us that (between the 1st of April 1891 and 30th June 1900) Rs. 5,82,000 was spent in restoring and improving minor tanks; would that all be masonry?—Yes, it is all on masonry.

23. Q. Do the ryots in the case of a breach do their work without compulsion?—Very often: it is to their interest to keep a tank in an efficient state, I think they readily do the earthwork and ask the Government to do the masonry.

24. Q. Do they do it readily without compulsion?—Here the obligation has existed a long time and it has worked fairly well.

25. Q. Do you think the Sulakeri does any irrigation at all?—It does irrigate. The total irrigable area is 3,733 acres of which 2,700 acres are irrigated. Some portion of the land has been reserved for date plantation.

26. Q. The land under the Sulakeri is black-cotton soil?—Yes, mostly, it is very fertile.

27. Q. It readily takes water?—Yes for wet crops, sugarcane and rice, there are also garden crops below it.

28. Q. You say in paragraph 33," the tanks are fast silting up, I have seen many tanks with a very shallow bed. I am unable to give statistics." Do you feel very certain that in your time tanks have gone out of use on account of silt?—Yes, they are fast silting up, even the Sulakeri will, I fear, get silted up in course of time.

29. Q. It is a very old tank?—Yes.

30. Q. Is there a great deal of silt in it?—Yes.

31. Q. How much water is there when it is full? Is it 30 to 40 feet deep?—I don't know the exact depth.

32. Q. If it has not silted up all these years, do you think it will silt up now?—I am talking of the smaller tanks, they receive a large amount of silt during the rains, there is no way by which the silt can be drawn off.

33. Q. Is there no remedy?—The only way is to raise the bunds.

34. Q. You cannot go on doing that for ever?—No.

35. Q. Is there plenty of room for fresh tanks in Mysore?—No, all likely sites have been converted into tanks.

36. Q. Do you find under tanks in Shimoga a great many wells?—For cultivating garden lands, &c., the landholders have sunk temporary wells under tanks.

37. Q. Why don't they take water direct from the tank?—They do and use the wells only in time of drought or in the dry months of the year when the tank is dry: it is only an auxiliary to tank irrigation.

38. Q. If they had a tank that would last right through the year?—They would not use wells.

39. Q. Are there cases of men possessing wells refusing to take tank water?—I have not come across any.

40. Q. They prefer to go to the tank?—Yes, it is easier, whereas a well means the cost of maintaining it.

41. Q. You say in paragraph 34, "the average depth of the well is about 30 to 40 feet." Do you mean wells under a tank?—They are generally below a big tank.

42. Q. Would you require to go down 30 feet under a tank?—Probably 200 to 300 yards away from a tank you might require to go down 30 feet—the temporary wells are shallow, but the permanent wells would be 20 to 30 feet.

43. Q. With a *picotah* could you raise from a depth of more than 10 to 12 feet?—No.

44. Q. You say "the selection of a spot for sinking a well is often a matter of great difficulty to the ryot." Very often you have to sink through rock?—In some places.

45. Q. Do they make a boring?—The wise man of the village is taken there, some people have the reputation of being able to indicate such places, he first makes a trial boring 3 to 4 feet in diameter and then makes a big one if he taps water.

46. Q. (*Mr. Ibbetson*).—What would that cost?—Rs. 5 to Rs. 10.

47. Q. (*The President*).—Does he never do it by boring?—No.

48. Q. Would the ryot think it a privilege if the Deputy Commissioner could lend him some boring tools?—He would have to be taught to make use of them. In the Maidan parts they would readily appreciate them.

49. Q. It would not cost very much to the Government?—I don't know what the cost would be.

Witness No. 36—M.R.Ry. M. S. Narayana Rao, Deputy Commissioner, Bangalore.

Written Evidence.

M.R.Ry. Narayana Rao.

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[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.

1. The answers refer to the Chitaldrug District. I was in charge of it for six years.

2. Information not available with me here but should be sent for.

3. (1) The population is sparse but there is enough to utilize any extended water-supply that may be made available.
(2) Same as above.
(3) No.
(4) In some cases black soil is met with, but that does not prevent the utilization of water if made available. In black soil it may be made available for occasional watering.
(5) Yes, in bad seasons, but not in the case of any large works.
(6) Yes, for very large works for initial expenditure.
(7) & (8) None whatever.
(9) None, so far as I could see.

4. In perpetuity and by retention of dry crop rate of assessment. There is a provision in the Land Revenue Code safeguarding the interests of tenants, but cases in which tenants effect improvements are very rare. They are sufficiently liberal.

5. Yes.
(1) Rate now imposed is sufficiently low.
(2) Not wanted.
(3) Not necessary.
(4) This is granted now.
(5) This is now allowed.
(6) Not wanted.

6. No; I am not aware of any such instance. On the other hand there seemed to me that a very keen desire existed for extension of irrigation.

B. C.

7 to 22. Not within my sphere of knowledge.

D.—Tanks.

23. (1) Tanks in the Chitaldrug District are filled either by rains exclusively and directly or by diverting water from running streams by dams thrown across such streams.
(2) The water is distributed by the agency of village headmen and other village servants.
(3) In the years of ordinary rainfall the supply is available throughout the year in the case of large tanks, but suffices only for a single crop from June to November or December in the case of smaller ones. In years of scanty rainfall the larger tanks barely supply for one crop, but in years of drought even they fail.
(4) Information not available with me here.

24. (1) Yes, it does in the case of large works in ordinary years.
(2) Rice is grown instead of ragi, but in a large number of cases the land is left fallow when water is not available for irrigation.
(3) In a year of ample rainfall the difference in favour of irrigated land is appreciable, but in years of scanty rainfall and of drought the advantage is very considerable, for then the crops' yield in irrigated land is little or nothing. The difference in favour of irrigated land is still more accentuated by the high prices realized for grain produced in that land.

25. The value is diminished not so much by too late commencement as by too early cessation, for in the latter case the failure damages the whole crop.

26. In some cases it is supplemented, and in such cases there is an absolute certainty of the crop being realized, and, wherever possible, it is of very great importance to afford this means of supplemental irrigation.

27. About 30 per cent., but the proportion rises in years of scanty rainfall and of drought to more than cent. per cent.

28. The cultivator when he happens to be a sub-tenant shares the produce with the owner or occupant that pays revenue to Government. The occupant's share is generally half, but when the tenant has to supply labour for lifting water, the owner's share is diminished in proportion to the labour involved. No water-rate is paid by tenants to superior holders. In the assessment paid to Government the difference between dry crop rate and that for irrigated land varies between 2 to 5 rupees an acre. In the case of assessment paid, the amount is paid on the whole irrigable area whether it is actually irrigated or not.

29. In the case of land that is newly brought under irrigation the land has to be levelled, and sometimes the level of the land itself has to be lowered to admit of irrigation. This involves expenditure more or less in accordance with the situation and variety of land that is thus operated upon. It is all borne by the landlord or occupant, and the only way of recoupment is by the greater security for realizing crops in the land and in the superior variety of crops realized in the land by means of irrigation.

30. The watching is done by village servants, repairs to stone and masonry work by Government, and silt clearance to irrigation channels and earthwork to bunds done by owners of land. No data are available as to the annual cost per acre for operations done by owners of land, but 8 annas per acre is considered sufficient. There are standing orders having the force of law laying down this obligation on owners of land.

31. No such case came under my personal observation.

32. Construction of new tanks and restoration of old tanks by private individuals, when Government cannot do it themselves, is a matter that certainly deserves considerable encouragement, and this can only be done by relaxing the rule now existing which permits only a reduction of one-fourth of the assessment levied on irrigated lands. No fixed rule can be laid down; each case has to be dealt with upon its own merits.

33. Yes; but in case of tanks containing a perennial supply the accumulation does not take place at the bund but at the edge of waterspread. The depth of accumulation each year depends upon the nature of the land by the overflow from which the tank is supplied. No attempts are made to remove silt, as the cost is considered disproportionate to advantage gained. Wherever possible, the level of waste weirs and of bund is raised; and very recently attempts were made to plant the margins of waterspread with trees so as to arrest silt there; but not much has been yet done in this direction.

E.—Wells.

34. The taluks in which wells predominate are Challakere, Molakalmuru, Hiriyur and Jagalur. These are noted in the order of importance. Water is also lifted in these taluks from streams direct and from wells sunk in the beds of streams. The average depth is 40 feet.
(2) Water is generally supplied from springs and from percolation, and liable to fail in the case of percolation in years of drought. In the case of spring wells the water-supply is materially reduced in years of drought, but seldom fails.
(3) The average cost of construction is Rs. 300.
(4) The permanent wells last for ever.
(5) By lift; bullocks being used to lift water.
(6) Four acres.
(7) Four acres.

35. (1) The yield is nearly doubled.
(2) The value of crop raised is increased by about 25 per cent.
(3) In a year of ample rainfall the yield is nearly double. In a year of scanty rainfall one crop is raised where none could be raised without the well. And in a year of drought the increased money value of crop raised more than compensates the shorter yield of crop.

36. I cannot give an approximate estimate.

37. (1) The owner shares in the increased produce realized.
(2) In the case of private wells, no enhanced revenue is paid to Government.

38. Difficulties are encountered both in the selection of suitable spots and in the actual construction of wells. No assistance has been given by Government except by giving advances of money in suitable cases. More can certainly be done by working District Officers in taking a keener interest in this matter.

39. No; it would create unnecessary complications. It is always good policy to leave the occupants unfettered in the operations of improving the land and the method of its cultivation.

40. They are not commonly used in the Chitaldrug District, and I am not in a position to say how far they are useful in years of drought.

M.R.Ry. Narayana Rao.

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MEMORANDUM of Replies by M.R.Ry. M. S. NARAYANA RAO, Deputy Commissioner, Bangaloro District, on points to be considered by the Irrigation Commission.

Dated 27th December 1901.

Query or Point for Consideration.	*Reply.*
List showing the names and designations of witnesses who may be selected for oral examination *in re* memoranda to be considered by the Irrigation Commission.	....

I.—POPULATION, AREA, ETC.

(*a*) Population of the district	788,368.
(*b*) Gross culturable area	843,912 acres 30 guntas.
(*c*) Average cropped area for five years	621,574 acres, or 73 per cent. of gross culturable area.
(*d*) Area irrigated in—	
(i) A normal year (1898-99) by private or village works.	*Nil.*
State irrigation works	53,782 acres.
Wells	14,902 ,,
Other sources	7,678 ,,
Total ..	76,372 ,,
(ii) A year of drought (1891-92) by private or village works.	*Nil.*
State Irrigation works	30,072 acres.
Wells	9,894 ,,
Other sources	6,907 ,,
Total ..	46,873 ,,

II.—GENERAL CHARACTER OF THE SOIL.

(1) Brief description of each important class of soil	1. Poor, shallow, red gravelly soil. 2. Red and sandy. 3. Rich and dark varying in proportions.
(2) Its distribution over the country	The first variety prevails more or less in all taluks but predominates in Magadi, Closepet, and Kankanhalli. The second variety is found in all taluks, and the third is not so very common, being found in favoured localities, especially on banks of large streams, or beds of tanks where alluvial deposits are continuously made.
(3) General experiences as to irrigation requirements of different soils.	1. Sand mixed with red soil requires much watering, inasmuch as the nature of the soil does not admit of any appreciable retention of moisture. 2. Loamy soil does not require so much irrigation as it can retain moisture. 3. In all these soils irrigation is very profitable, the sandy soils needing more frequent watering than the richer ones, but the surplus of the former is available for lands lower down in the valley.

III.—BLACK SOIL.

(*a*) Experience as regards black soil	Black soil is not much to be found in this district but scattered here and there.
(*b*) Experience of small tanks constructed in such soil to hold water.	Yes, they hold water.
(*c*) Can high earthen dams be made of it without masonry core-walls?	No, but masonry walls are not wanted; if gravel backing is provided, the bunds become sufficiently watertight.
(*d*) When the land irrigated is a black soil—	
(i) Is there any demand for water during the seasons of (1) average rainfall; or (2) in case of prolonged drought?	No. There is a demand, but there are no means of supplying it.
(ii) In such soil, does the irrigated area show a falling off in years of fair or good rainfall owing to slack demand?	The irrigated area does not fluctuate to any appreciable extent in proportion to rainfall, except in so far as it affects the supply of water in tanks.
(iii) Is the revenue more precarious on this account than on works commanding other classes of soil?	No.
(iv) Has there been a desire for irrigation works on the part of owners of black soil?	No, but there is a demand for constructing small reservoirs for retaining moisture in beds (*e.g.*, Chitaldrug District).
(v) Is the construction of works for such soil considered as remunerative or as important as for other classes of soil?	No; unless provision is made for occasional watering when rains fail.

IV.—STATE IRRIGATION WORKS.

(*a*) 1. Number	1,256.		
2. Description	3 tanks of a revenue of Rs.	5,000	& upwards.
	75 do.	1,000	to 5,000
	92 do.	500	to 1,000
	109 do.	300	to 500
	405 do.	100	to 300
	572 do.	under Rs.	100
3. Total Capital cost			

(*b*) Total area irrigated by the works—	
1. In a dry year	46,873 acres.
2. In a normal year	76,372 ,,
(*c*) 1. Average annual working expenses	Working expenses are not incurred on tanks in this district, except the following :— (1) Abbur anicut .. .. Rs. 132 } Rs. (2) Hoskote large tank .. ,, 792 } 924.
2. Total revenue	Rs. 2,55,177-12-6.
3. Net revenue	Rs. 2,54,253-12-6.
(*d*) Are these works to be depended on in a season of drought?	No.

V.—Future Extensions.

Are any new works of considerable size proposed, or considered possible in Mysore?	1. Vrishabhavati project.
(*a*) In what tracts?	Closepet Sub-Taluk.
(*b*) What would be the probable area of new irrigation?	Information not available in the Deputy Commissioner's Office.

VI.—Village or Private Irrigation Works.

(1) Are there any village or private irrigation works excluding wells?	Yes; Inam tanks.
(2) If so, by whom are they constructed and maintained? ..	Maintained by Inamdars.
(3) Number of such works	349 Inam tanks including kodigi tanks.
(4) Aggregate extent of cultivation dependent on them? ..	11,608 acres.
(5) Is any expenditure incurred by the State on these works?	No. In case the Inamdars fail to execute the required repairs, they are executed by Government and the cost recovered from them.
(6) Any increase in revenue direct or indirect from them? ..	None.
(7) Is there any considerable scope for the construction of new works of this class?	No.
(8) If so, in what tracts?	*Nil.*
(9) The probable area of new irrigation	*Nil.*

VII.—Crop irrigated, etc.

(1) (i) What are the crops usually irrigated in each season by—	
(1) Canals	*Nil.*
(2) Tanks	Rice and sugarcane.
(3) Wells	Sugarcane, potatoes, vegetables, etc.
(ii) How many waterings do they usually require? ..	Twice a week.
(iii) During what period is water given out?	From the commencement till about the harvest.
(iv) How is the distribution controlled from—	
(1) Canals	*Nil.*
(2) Tanks	The water in tanks is distributed to fields by nirganties and supervised by the patel.
(3) Wells	By owners.
(v) Time for which water is alloted to each cultivator how determined?	No data available.
(vi) What is considered a fair average duty per cubic foot per second of discharge or per million cubic feet stored, including loss by evaporation, absorption, etc.?	The levy of tax is not regulated in this way in this district.

VIII.—Statistics for Typical Works.

Statistical information regarding some of the larger or typical storage works.	1. Bellandur. 2. Hoskote Dodkere. 3. Malur tank.

(i) *Initial Statistics.*

(1) Area and nature of catchment	Information available in the Public Works Department.
(2) Assumed average annual rainfall	(1) 39·82, (2) 24·89, and (3) 37·67 inches.
(3) Full supply capacity of tank in m.c.ft	Public Works Department.
(4) Percentage of capacity on average rainfall	
(5) Water spread at full supply	
(6) Maximum height and total length of dam	
(7) Cost of dam, waste weir, sluices	
(8) Compensation for land submerged by tank	
(9) Cost of canal and distributing channels	
(10) Total capital cost	

(ii) *Annual Statistics for each year since completion.*

(1) Rainfall of the year	Public Works Department.
(2) Amount stored during year	
(3) Amount run over waste weir	
(4) Total run off for the year	
(5) Percentage of run off on rainfall of the year	
(6) Area irrigated during the year	
(7) Quantity of water, if any, left in tank at end of irrigating season and available for next year.	

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IX.—Flood Protection, etc.

(1) Districts in which flood protection or drainage works are required.	*Nil.*
(2) Are these of sufficient urgency to be carried out whenever funds may be available?	No.
(3) Or may it be reserved for the employment of relief labour?	No such work.
(4) Would such work lead to any increase?	*Do.*
(5) Or prevent any loss of land revenue	*Nil.*
(6) Or are they recommended only on sanitary ground? ..	No.
(7) Or as a means of employment for relief labour?	No.

X.—Relief Works.

(1) On what classes of work was relief labour mainly employed during the late famine?	During the famine of 1876-77 relief labour was employed in making roads, opening out railway lines, and constructing new and improving old tanks.
(2) Were any new irrigation works commenced and left incomplete?	None remain incomplete.
(3) Were any new works completed?	One tank.
(4) Or if not completed, is it now proposed to complete them?	None.

Oral Evidence.

1. Q. (*The President*).—I understand you are Deputy Commissioner of Bangalore?—Yes.

2. Q. How long have you been in this capacity?—A little over six years.

3. Q. I suppose you know the other districts of Mysore?—Yes, to some extent, Chitaldroog most intimately.

4. Q. That has suffered most from famine, has it not?—Yes.

5. Q. Has there been any famine or scarcity since the famine of 1877?—There was some scarcity in 1891, but it did not affect the population seriously.

6. Q. Supposing a famine were to come here again, would the district be in a better position to withstand it than it was twenty-four years ago?—Yes.

7. Q. What is that due to?—To the creation of new public works that are now in progress, especially the Mari Kanave work.

8. Q. Has the Mari Kanave come into operation?—No water has been let out yet.

9. Q. You anticipate that there would be a large amount of irrigation from that tank?—About 30,000 acres would be irrigated.

10. Q. What soil is it?—Red and sandy soil which is adapted for irrigation, there is some extent of black soil for which occasional waterings may be allowed.

11. Q. You say in reply to question No. 3 "in some cases black soil is met with, but that does not prevent the utilization of water if made available. In black soil it may be made available for occasional watering." You must mean for dry crops?—Yes, whenever dry crops are liable to fail, one watering is enough to bring the crops to maturity.

12. Q. I believe that in this Province it is not the practice to water dry crops?—Yes, it does happen in Chitaldroog.

13 Q. You give total remission in the case of failure to obtain water in a well, when an advance is given?—Yes, when a well fails through no fault of the person to whom the advance is given.

14. Q. How do you make sure that it is not the fault of the man?—I make enquiries.

15. Q. If he spent half his advance for other purposes and got no water would you remit?—Not in such a case.

16. Q. Do such cases occur?—Yes, but the District officers are expected to watch such cases.

17. Q. You say there seems to be a very keen desire for extension of cultivation throughout the Maidan?—Yes, my remark chiefly refers to Chitaldroog. I was in the survey before.

18. Q. As regards the Mari Kanave tank, where does it get its water from?—Its prime source is in the Kadur district.

19. Q. Supposing that reservoir had been in existence at the time of the great famine would it have contained water?—It would have contained some water, no doubt, capable of irrigating 10,000 acres perhaps.

20. Q. Have you any large reservoirs in connection with the ghâts?—No.

21. Q. With reference to what you say in paragraph 33 about tanks silting up, have you seen tanks thrown out of use in that way?—No, but I have seen a large accumulation of silt.

22. Q. Do you know how many years it took to accumulate?—No.

23. Q. Can you think of any tanks which contain less water than they used to do before?—The capacity of tanks has been very much reduced as is evidenced by the reclassification of water works in the Chitaldroog district, the original classification has been very much reduced, what were first-class tanks before have been reduced to something between first and second class.

24. Q. When was the former settlement made?—Between the sixties and seventies.

25. Q. In that time it has been necessary to reduce the classification of the tanks. Do you put that down entirely to silt?—Yes.

26. Q. Not to the tanks being in a worse state of repair or to settlement officers being more lenient?—No, perhaps the standard is different, and there are not the same officers as classed these tanks, but the prime factor seems to be the silt.

27. Q. Do you think it would be a good thing for the rayats if Deputy Commissioners had boring tools which they could lend them?—Yes, an expert to help the rayats would be of real service.

28. Q. Do you know of cases in which from want of that special knowledge men have spent money and got nothing?—Yes.

29. Q. Do you think it has often occurred, have there been large remissions?—No, the failure has been in very few cases.

30. Q. They are allowed thirty years to repay an advance?—Yes.

31. Q. Is that complained of as being too short a time?—No.

32. Is the rate of interest complained of?—No, it is only 3 per cent.

33. Q. (*Mr. Ibbetson*).—A good deal of money has been spent in restoring some of the tanks in Mysore. Have these tanks come under this reclassification?—Yes.

34. Q. Has the restoration raised the value of the tanks?—Yes.

35. Q. The restoration has never included any clearance of silt?—No.

36. Q. The restoration consists entirely of repairs to the bunds and sluices, etc.?—Yes, and raising the waste weir also.

37. Q. Has the classification of tanks been raised much by the restoration?—No.

38. Q. The direct returns under revenue are very small, do you think that the water-supply has been so improved that when the revised settlement comes on Government will get a fair return for its expenditure?—(No answer.)

39. Q. Do you think that you will actually be able to raise the revenue much upon those tanks that have been restored?—There has been an extension of cultivation.

40. Q. Do you think there has been much increase? What is your impression?—There will be a little appreciable increase, not very much.

Witness No. 37—M.R.Ry. B. Ranganna, Retired Amildar.

Written Evidence.

M.R.Ry. Ranganna.

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[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. The answers to the questions below apply generally to the Kadur Taluk of the Kadur District.

Since I live for the past twenty years in Buksagara, a village in the Kadur Taluk, and since I am a holder of more than 70 acres of wet land, and since I am carrying on the cultivation under my own personal supervision, I answer these questions from the little knowledge I have acquired throughout an experience of twenty years, and I say that which I consider true.

2. During the monsoons the average rainfall in each month is about 2½ inches and during other months it is 1¼.

3. (1) and (2) Yes, in parts of the Kadur Taluk.

(3) Yes, there is in parts.

(4) There is hardly any obstacle in these parts to extension of irrigation arising from unsuitability of soil.

(5) Yes, as there is a large area under irrigation already and the holders of these lands experience great difficulties in obtaining water when it is absolutely required. There is a great obstacle arising from this cause to extension of irrigation.

(6) Yes, but the provision made by Government for obviating these difficulties, in the Land Improvement Loans Regulation of 1890, have not been availed of by the public for reasons stated in answer to question 5 below. The provision made by the rules published under Notification No. R. 2557, dated 10th December 1901, will, it is expected, obviate the difficulty.

(7) Yes; owing to uncertainty of water-supply and the consequent loss to the ryots by way of loss of seed-grain and cost of cultivation as compared with lands not irrigated, the ryots are very much afraid of the increased assessment on wet lands existing at present.

(8) Scarcity of rayats prevails in these parts. They possess dry lands of their own. So they usually sow crops in their lands in the season, and when the season has passed away they come and sow the crop in the fields which are assessed at high rates and which they have taken from the landlord for cultivation on the "vara" system. The landlord suffers a great loss from this. If the landlord insists upon his tenant that he should cultivate the land at the proper time, and that by working hard and by careful supervision he should turn out a good crop in the field, he will not accept these terms, but quietly say that they do not want to cultivate the land in question. From this cause, and for reason described below, and by the reason of there being no fixed tenancy law, there is great obstruction to the cultivation of irrigated lands.

(9) There are many pigs in these parts; these cause great damage to the valuable crops grown on irrigated lands, such as paddy, sugarcane, Bengal gram, and coriander, by eating the crops, by trampling them down, and by digging the ground on which there are crops. Much inconvenience is caused to the rayats as they will have to keep watch during nights throughout. Whatever watch may have been kept, yet the loss from wild pigs is infallible. It is really a great bother to keep watch during nights throughout. This causes a good deal of fear both to the landlord and to the tenant to cultivate such valuable crops as sugarcane, etc. If the Government will kindly favour us to have these wild pigs shot down for some years, so that the fear of this disaster may be completely driven from the minds of the rayats, the bother of night watch is saved, and consequently it will be convenient for rayats to take up larger patches of wet lands for cultivation and thus increase the cultivation of irrigated lands. If this is not done, the rayats will be unable to grow valuable crops on their wet lands, and this will be a great obstruction to the waste lands being taken up for cultivation. It is a hopeless task for either the landlord or the tenant to arrange for destroying them.

4. People have not constructed any irrigation works by private capital in the Kadur Taluk.

5. People in these parts do not seem to have freely taken loans from Government for the purposes mentioned in the Land Improvement Loans Regulation No. IV of 1890. But I have taken loan from Government. Loans must be made payable at least three months after the date of application.

In these parts people consider gardens which contain arecanut and cocoanut trees to be more productive and more permanent than other crops grown on wet lands. Many desire to lay out gardens afresh. People who have lost many trees in their gardens very much desire to replant them with fresh plants and thus restore them to their former condition. If the Government makes known to all the people by causing hand-bills distributed broadcast amongst them that loans would be granted for such purposes at a low rate of interest, and that a sufficient time for repayment of the principal and interest will be allowed, many people may come forward to take loans. Sufficient time means a term until the trees newly planted begin to yield, *i.e.*, a term of 20 years. It cannot be expected that all the plants planted for the first time will yield. New plants will have to be substituted for the last ones, and these require some time to yield. All trees will begin to yield in 20 years. For this reason the rate of interest will have to be reduced from 5 to 4 per cent. The Government will have to kindly arrange for the proper supply of water to those lands for the benefit of which loans are granted.

(1) The matter of the reduction of interest has been said above.

(2) When crops fail, and when the trees in the garden wither away for want of water, it is desirable that there should be remission of the interest.

(3) Partial remission of the advance to be made in case of partial failure of the attempt to obtain water.

(4) Yes; if in the attempt to obtain water the whole amount of the loan is justly spent, and if he fails to get the necessary supply of water, Government may make remission of the whole amount of the loan.

(5) Except in cases where loans are advanced on gardens, the time of repayment allowed in all other cases is ample.

(6) Amount advanced from Government under the head of Grants-in-aid is a matter of extraordinary concession, and I would recommend it where the undertaking would prove beneficial to the people in the vicinity by inducing them to settle and cultivate large areas of land lying fallow in difficult tracts.

6. It is rare in these parts that people leave their native places and go to other places in search of wet lands. If by chance anyone does so, his neighbours or some others of the neighbouring villages buy up his lands because now-a-days conveyance by railways has become very easy and the crops produced will be exported to foreign countries and the prices do not fall. Increase of cultivation year by year is an instance of this. So there will be no obstruction to the cultivation of those lands whose owners go away to other places in search of wet lands.

In these parts there are many villages with dry lands. In such places there is great inconvenience of water in summer for people and cattle. Occasionally there will be inconvenience to there being good crops in dry lands owing to the untimely fall of rains. People greatly desire to have irrigation extended to these parts.

B.—Canals of Continuous Flow.

7-11. As there are no canals of continuous flow here, the questions belonging to this item cannot be answered.

C.—Canals of Intermittent Flow.

12-22. It is possible to answer some of the questions under this heading, and as I have not got sufficient experience to answer the rest of the questions, I have to stop answering these questions.

D.—Tanks.

23. (1) *General description.*—The famous tanks, viz., Iyyanakere and Madagadakere, are generally supplied by rain water and by the moisture deposited on the mountains by the South-west Monsoon in the Malnad parts flowing into the tank in jungle channels in the months of July and August. Ordinarily, other tanks are not supplied by the South-west Monsoon alone. These are generally supplied by heavy showers of rain in the South-west and North-east Monsoons.

(2) The water in the tanks begins to flow from the inside of the sluice and from there it comes and collects in a ditch on the other side of the tank bund, and therefrom flows in a big channel made for the purpose. Smaller channels are made across this channel, and water is made to flow in the small channel, and this small channel leads water to the field and irrigates it.

(3) (*a*) In a year of ample rainfall the supply of water in a tank may be ordinarily maintained for a year.

(*b*) In a year of scanty rainfall the water in the tank will be useful for the crops for three or four months.

(*c*) In a year of drought, in a year of practically little rainfall, the water in the tank will be sufficient for fifteen days or one month.

(4) About 25 acres may be ordinarily irrigated from a tank.

24. (1) If two crops instead of one are grown in a wet land, the value of the produce increases in the ratio of 1 to 1½. When a second crop is grown upon the same land, the fertility of the soil will have been diminished by the first crop, and consequently the second crop will not yield so much as the first crop.

(2) If more valuable crops are substituted for less valuable crops or varieties, the value of the produce increases in the ratio of 1 to 2.

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(3) (*a*) In a year of ample rainfall, though the yield increases, the price decreases. But still the value of the total produce increases in the ratio of 1 to 1¼ or 1 to 1½.

(*b*) In a year of scanty rainfall the produce is less, but the rates will be somewhat high. The quantity grown being small, the value of the produce may be said to be ordinary.

(*c*) In a year of drought, if there is no water in the tank, no crop can be grown. Probably there will not be water sufficient in the tank for the harvesting of a crop, and so it is not possible to say anything about the value of the produce in a year of drought.

25. There will be no crop when the water-supply ceases too early. There will be a poor crop when water-supply begins very late.

26. It is not common in these parts to supplement tank irrigation by irrigation from wells built at private cost. But when there is no water in the gardens, wells are dug in the gardens only and the water thereof will be used for irrigating the garden. This saves many trees which would have completely withered away but for the well.

27. (1) Though a land is subject to irrigation it cannot be said that its crops will increase every year. Crops sometimes undergo a great loss owing to untimely rains and diseases. So it cannot be said that the value of produce of an irrigated land increases every year. On the average of a normal term of years in which there was increased produce in some years and less produce in some years, the average increase in the value of crops from an acre of wet land on which cultivation other than garden cultivation is made is about 25 per cent.

(2) The answer above to question (c) of subsection 3 of section 24 applies to this also.

28. (1) There is [illegible] here who [illegible] rental [illegible] consequently [illegible] pay to any person the [illegible] of water-rate or otherwise.

(2) The [illegible] usually cultivate the lands of others under the "[illegible]" system of cultivating. "[illegible]" system of cultivation [illegible] half of the produce of the land to the landlord and keeps the other half for the cultivator. [illegible] of cultivating lands on the "[illegible]" system also exists in these parts. Under this the tenant has to give to his landlord a fixed quantity of the produce as previously agreed upon. It is rare that people take up others' land and pay the rent and cultivate it. This is all that exists here. [illegible] that the [illegible] pay [illegible].

(3) If a cultivator has to convert dry land to an irrigated land, he will have to pay nearly Rs. 4-1-0 per acre [illegible] the assessment on dry land at nearly Re. 1 per acre and water-rate at nearly Rs. 3-4-0 or Rs. 3-8-0 per acre. This is what the holder ordinarily pays to Government for the advantage of the supply of water. When once a land is classified as wet, and when once a water-rate is charged upon a land, the landholder pays the wet assessment and water-rates, whether he enjoys the advantage of a fair supply or not, to the above. This has been the practice here. He does not pay wet rates for the other dry lands he holds.

29. To render a land fit for irrigation, the landholder has to bring a channel to his field which should be in connection with the channel in which water flows. If the land is not of a uniform level, it is necessary that he should make it so to convey the water. He has to make beds in the fields for water to come and stand in. If he has to irrigate a jungle that is newly taken up for cultivation, he will have to clear land of trees and he will have to dig out the roots. All these expenses will have to be borne by the landholder, and tenant does not bear these charges.

30. Ordinarily, silt in tanks is not removed. Rules exist for the maintenance of the bund of tanks restored to standard and formally handed over to the ryots for upkeep and for silt clearance. The annual cost of maintenance is about 4 annas per acre [illegible]. The rules in force seem to work fairly well.

31. As [illegible] these parts [illegible] any tanks in this part of the Province, this question cannot be answered.

32. Perhaps it may be expected to wealthy persons who are desirous of constructing tanks with their own private capital. The Government may help them by the remission of a half, a third, or [illegible] of the assessment [illegible] upon the lands irrigated by that tank, having due regard to the [illegible] of construction.

33. No. [illegible]

Silt is [illegible] used by ryots by the ordinary process of digging only when they require it for manure.

F.—Wells.

Wells [illegible] to a depth of 50 feet in these parts, [illegible] large [illegible] for irrigation purposes. There is therefore hardly any irrigation from wells in these parts, and I have no experience of it.

Oral Evidence.

1. Q. [illegible] you have spent your life in Mysore?—Yes.

2. Q. You have [illegible] great changes in Mysore and [illegible] remember the terrible famine [illegible] such a famine were to come again do you think the country is in a better position to withstand it?—It is better able to withstand the famine as a number of roads and [illegible] have been made.

3. Q. There were always a great many tanks in Mysore. Are there more tanks than when you were young?—Not many more tanks.

4. Q. How is it better able to withstand a famine than it used to be?—More roads and [illegible] have been made.

5. Q. You live in the Kolar taluk?—Yes.

6. Q. You say "owing to the uncertainty of water-supply and the consequent loss to the ryots by way of loss of seed-grain and cost of cultivation as compared with lands not irrigated, the ryots are very much afraid of the increased assessment imposed for [illegible] at present." Are prices not higher than they were. Why are the people afraid?—The general impression is that the rates imposed at the Survey Settlement are too high on account of want of sources for the supply of water [illegible] they feel the burden too high.

7. Q. I suppose they are getting better prices in consequence?—If there is a general rise of prices and a general fall of quantity of crops then the increased price will compensate for decreased outturn, but in individual cases for want of proper facilities people lose their crops and the general outturn is pretty much the same.

8. Q. In paragraph 23 you say, "the famous tanks, viz., the Iyyanakere and Madagadakere are generally supplied by rain water." Where are these tanks?—In Kadur taluk.

9. Q. How much irrigation is there under these tanks?—I cannot say, roughly, about Rs. 16,000 is realized under the Madagadakere tank and a little less under the Iyyanakere tank.

Witness No. 38—Colonel D. McN. Campbell, R.E., Chief Engineer, in Mysore.

Written Evidence.

Colonel Campbell.

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[*Note.*—The numbering of the paragraphs refers to the printed questions for Public Works Officers.]

1. *Population, Area, etc.*

Statement of total area cropped, 1899–1900.

District.	Population, 1891.	Cultivable area.	Area cropped, 1899–1900.	Percentage of cropped to cultivable area.
		ACRES.	ACRES.	
Bangalore ..	802,994	1,098,880	651,323	59·2
Tumkur	580,786	1,632,000	973,691	59·6
Kolar	591,030	867,840	479,412	55·2
Mysore	1,181,814	2,023,040	1,407,256	69·5
Hassan	514,952	1,000,960	717,151	71·6
Shimoga	527,981	989,440	635,452	64·2
Kadur	330,063	673,920	491,230	72·9
Chitaldrug ..	413,984	1,594,240	1,148,047	72·1
Whole Province..	4,943,604	9,880,320	6,503,562*	65·5

* There is a discrepancy of six acres between this and the total given for the whole Province in the Mysore Atlas of 1900.

The total area cultivated in 1899–1900 is divided as follows:—

Dry acres.	Wet acres.	Gardens acres.	Coffee, Chinchona, Cardamoms.	Total.
5,317,508	773,677	243,611	168,760	6,503,556

The following is the proportion of each of the above crops to the cultivable area:—

Dry	53·8
Wet	7·8
Gardens	2·4
Coffee, Chinchona, Cardamoms ..	1·7
	About 65·5 per cent.

The proportion between the cultivable area and the population is 1 person for 1·1 acre for the whole Province, and 1 person for every 2 acres of the entire Province both culturable and uncultivable.

Statement showing the average area of land irrigated for the last ten years, 1890–1900.

District.	Extent of land irrigated average, 1890–1900. Acres. River channels.	Tanks.	Other sources, wells and springs.	Total wet cultivation.
Bangalore	19	43,452	4,737	48,208
Tumkur	937	52,906	7,681	61,524
Kolar	1,428	49,964	2,288	53,680
Mysore	61,253*	32,632	6,131	100,016
Hassan	9,947*	72,956	20,475	103,378
Shimoga	3,111	105,649	108,167	216,927
Kadur	5,445	33,206	65,483	104,134
Chitaldrug	2,190	21,769	1,205	25,164
Whole Province ...	84,330	412,534	216,167	713,031

* These figures do not agree with those given under Canvery channels; the reason being that the area under tanks fed by the channels is entered under tanks.

These figures are compiled from the Mysore Atlas of 1900. The total 713,031 acres does not quite agree with the average area of wet cultivation for ten years for the whole Province, which is given at 748,068 acres. The difference can probably be accounted for by mulberry and sugarcane not being included in the former figures.

Statement showing the proportion of wet cultivation to culturable area.

District.	Proportion of wet cultivation to culturable area. River channels.	Tanks.	Other sources.
Bangalore	·0017	3·9	·43
Tumkur	·05	3·2	·4
Kolar	·14	5·7	·26
Mysore	·3	1·6	·3
Hassan	·99	7·2	·2
Shimoga	·31	10·6	10·9
Kadur	·81	4·7	9·4
Chitaldrug	·13	1·3	·07

There have been no seasons of drought since 1876–77. The following table gives the area of wet cultivation in a year of bad and good rainfall respectively in each of the Maidan districts of the Province:—

District.	Average Rainfall, 30 years.	Bad year. Year.	Rainfall.	Area of wet cultivation.	Good year. Year.	Rainfall.	Area of wet cultivation.
				ACRES.			ACRES.
Bangalore	29·86	1891	18·41	42,034	1893	41·13	50,074
Kolar	27·58	1891	16·16	42,916	1893	29·8	54,510
Tumkur	25·98	1891	16·5	51,935	1893	33·04	63,316
Mysore	27·22	1891	17·7	95,109	1893	33·78	96,726
Chitaldrug	20·76	1891	14·06	23,274	1893	29·04	24,566
Total ..	..	..	..	255,268	....	..	289,192

It will be seen from this that the difference between the area of wet cultivation in a bad and good year is only 33,924 acres in the whole Province.

I am sorry I can give no information about private or village irrigation works.

2. *Soils.*

The prevailing soil in the Province is red loam formed by the decomposition of gneiss and trap. Black-cotton soil is found here and there, chiefly in the Kadur, Shimoga and Chitaldrug districts. The red soil is generally very fertile and is well adapted to irrigation. The black-cotton soil is more suited to dry crops, but can be irrigated with advantage. As far as as I know, no difference is made in the quantity of water supplied to cultivation on different kinds of soil.

3. *Black-cotton Soil.*

There are many small tank bunds in this Province, constructed of black-cotton soil, that do not leak. I have myself constructed a bund of black-cotton soil to hold 30 feet depth of water, with no masonry core-wall but with a puddle-wall in the centre. This has stood for 20 years. The large Kukasandra tank in the Kadur district has a bund of black-cotton soil, but the front under the revetment is made with several feet in thickness of good soil. Black-cotton soil dries and cracks badly in the hot weather and a bund made of it is likely to leak and perhaps breach if it has not been soaked with rains; but in the case of tanks which cannot fill unless there has been rains, the bund is nearly always saturated. In the case of channels it is different, and I have known water let into one when the banks of black-cotton soil were dry, and the result was excessive

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leakage and several breaches. The remainder of this question can best be answered by the Revenue officers as they have the distribution of the water.

4. State Irrigation Works.

This can be seen in a bulky statement prepared in the office of the Examiner, Public Works Accounts.

The expenditure from 1881 to 1900 is Rs. 198,03,000.

The total area irrigated in a good and bad year has been given in my answer to question No. 1.

The total revenue derived from all sources of irrigation except wells and springs is Rs. 27,38,933 for 1899-1900.

The average annual cost of repairs to the channels under the Public Works department is Rs. 70,000 and the cost of establishment Rs. 1,200 per mensem, or Rs. 14,400 per annum.

The average cost of the establishment employed on tanks is Rs. 18,000 per annum.

The average annual amount expended by the Deputy Commissioners on masonry works to tanks is Rs. 25,000 : the earthwork is done at the cost of the rayats.

The total yearly cost of the upkeep of irrigation works is therefore –

	Rs.
Channel repairs	70,000
Establishment	14,400
Tank repairs	25,000
Tank establishment	18,000
Total ..	1,27,400

This does not include cost of direction and accounts.

Deducting Rs. 1,27,400 from the gross revenue of Rs. 27,38,933, the net revenue is Rs. 26,11,533, which is about 13 per cent. on the capital expenditure since 1881. But this large percentage is no doubt due to the expenditure incurred prior to 1881, and I do not see how it is possible to ascertain the capital cost of all the irrigation works in the Province.

The expenditure on irrigation works from 1799 to 1900 (omitting that for the years 1810 to 1831, which is not known) is Rs. 2,56,54,177, and the present net revenue would give a return of about 10 per cent.

The works are not to be depended on in seasons of drought, with the exception of the Cauvery channels and tanks fed by perennial streams in the Malnad tracts of the Province.

5. This is fully answered in my memorandum, dated 20th December 1901.

6. I cannot answer this question ; it is a matter for the Revenue department.

7. Most of this question is answered in my memorandum, dated 20th December 1901.

The distribution of water is under the Revenue authorities, except under the Cauvery channels during the dry season ; so details regarding number of watering, etc., can best be obtained from the Revenue officers.

8. I have referred this to the Superintending Engineers, and when the information is received I will attach it to this memorandum.

9. No flood or drainage protective works are required in this Province.

10. There has been no famine since 1876-77.

Note.– The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. To the Mysore Province generally. Information gathered during 5½ years. Chief Engineer of Mysore.

2. Average monthly rainfall for the 30 years, 1870--1900, taken from the Report on Rainfall Register in Mysore for 1900 by the Director of Meteorology in Mysore :—

District.	January.	February.	March.	April	May.	June.
1	2	3	4	5	6	7
Bangalore ..	·03	11	·35	1·15	3·82	2·55
Kolar	·03	·09	·29	·94	2·89	2·42
Tumkur	·03	06	19	1·39	2·93	2·52
Mysore	·08	·08	·44	2·05	4·86	2·01
Shimoga	·09	·03	·26	1·65	2·92	13·48
Hassan	·02	·07	·33	2·13	3·83	4·93
Kadur	·13	·12	·43	1·97	3·72	11·26
Chitaldrug ..	·04	·02	·17	1·22	2·60	2·19
Whole Province ..	·06	·07	·31	1·56	3·45	5·17

District.	July.	August.	September.	October.	November.	December.	Total.
	8	9	10	11	12	13	14
Bangalore.. ..	2·87	4·5	6·01	5·66	2·34	·46	29·86
Kolar	2·79	3·81	5·45	5·21	3·02	·64	27·58
Tumkur	2·46	3·00	5·63	5·22	2·16	·39	25·98
Mysore	1·85	2·73	4·32	5·86	2·44	·50	27·22
Shimoga	22·35	12·73	5·70	5·32	1·66	·26	66·35*
Hassan	7·04	4·47	4·07	5·74	2·59	·59	35·81
Kadur	17·46	10·56	5·82	6·52	2·22	·52	60·73*
Chitaldrug ..	2·20	2·06	4·39	3·66	2·05	·16	20·76
Whole Province ..	7·38	5·48	5·17	5 40	2·30	·44	36·79

* Includes the Malnad portion of the districts.

3. (1) I think sparsity of the population would be an obstacle to the extension of irrigation in some parts of the Province.

The density of the population, taking the Census of 1891, is :—

Bangalore District,	per square mile	..	259
Kolar	do.	do.	.. 181
Tumkur	do.	do.	.. 139
Mysore	do.	do.	.. 237
Hassan	do.	do.	.. 199
Kadur	do.	do.	.. 119
Shimoga	do.	do.	.. 112
Chitaldrug	do.	do.	.. 102

These figures are taken from the Mysore Atlas of 1900, and do not quite agree with the figures given in Rice's Gazetteer.

In the last named district there are only ·16 persons per acre, and in one of the taluks, namely Hiriyur, there is only ·1 person per acre. This is one of the taluks that will be irrigated by the Marikanave Reservoir, and it is doubtful if all the land available will be taken up for cultivation, owing to the sparsity of population. I believe there are instances in other parts of the Province where there has not been the anticipated increase of cultivation owing to the same cause.

(2) and (3) Are questions best answered by the Revenue Department.

(4) There are eight varieties of soils in the Province. There is not much black-cotton soil, and what there is is chiefly in the Chitaldrug district.

My experience is that black-cotton soil is not unsuitable for wet cultivation ; but as it retains moisture for a long time, it is well suited for dry crops. In the Chitaldrug district the rayats often throw up small bunds across depressions, and the water retained by the bund soaks into the black-cotton soil, and dry crops are grown on it.

I do not think the rayats of Chitaldrug are keen about wet cultivation though the district is the one most liable to drought.

(5) I do not think so, except for six months. Under the Cauvery channel and tanks fed by perennial streams there is no uncertainty of supply ; but this does not deter the rayats from cultivating wet under other sources. If a rain-fed tank is constructed to hold enough water for the irrigation of say 100 acres, that extent of land will be taken up (should the rayats wish to grow wet crops) regardless of the fact that the supply may fail in bad years.

(6) to (9) Are questions that can be answered in the Revenue Department.

4 and 5. These are also Revenue questions.

6. I don't think so ; certainly not in my experience. It is difficult to get rayats to leave their villages to cultivate elsewhere.

I think it may be stated generally that rayats who are in the habit of cultivating wet crops are desirous of having irrigation extended ; but those who have been accustomed to cultivating dry crops are not keen about irrigation.

It must be remembered that the staple food of this Province is ragi flour, and ragi is grown dry ; so there must always be a large area devoted to this crop.

Petitions are often received for the restoration and extension of irrigation works and sometimes for the construction of new ones; and in these petitions it is represented that a large area of wet land will be taken up after the construction of the works; but I believe that in most cases not even half the anticipated increase is ever realised, due either to the land not being taken up, or to the wet assessment not being levied

I, some years ago, asked the Deputy Commissioners through the General Secretary to send me statements showing in each district the increased area of wet cultivation and revenue during the last ten years, due to the construction or restoration of irrigation works costing Rs. 25,000 or more.

I have only received the statements for three districts, Tumkur, Chitaldrug and Kolar, and the following are the results:—

In the *Tumkur district* the sum expended on completed works during the last ten years is Rs. 6,93,773. The increase of cultivation being 3,348 acres and the increase of revenue Rs. 9,771 or 1·4 per cent. on the expenditure, which is far below the anticipated increase; but all the expenditure incurred was on the restoration of works which irrigated altogether 4,128 acres, the revenue from which would have been lost had the work of restoration not been carried out.

In the *Chitaldrug district* the total amount expended on completed works has been in the last ten years Rs. *4,28,513*. The increased area of cultivation being 2,433 acres and the increase of revenue Rs. 4,708 or 1·09 per cent. Most of the expenditure was on restoration, by which loss of revenue was prevented.

In the *Kolar district* the expenditure on completed works during the last ten years has been Rs. 6,24,177, and the increase of cultivation and revenue 1,971 acres and Rs. 10,748 respectively. The latter figure gives a return of 1·71 per cent. on expenditure.

Of the works, 3 are new ones completed three to four years ago.

One cost Rs. 1,65,095. The anticipated area of wet land and revenue being 619 acres and Rs. 4,295 respectively. The actuals being 514 acres and Rs. 1,806, giving a return of only 1 per cent.

Another cost Rs. 88,611, and the anticipated increase was 220 acres and Rs. 1,540; but the actuals are 147 acres and Rs. 513, giving a return of ·5 per cent.

The third cost Rs. 1,68,349, the anticipated increase being 915 acres and Rs. 5,789. The actuals are 240 acres and Rs. 1,659, giving a return of ·9 per cent.

It is probable that the results in the other districts are similar, and it appears to me to show that the rayats are not eager to take up land for wet cultivation; but perhaps some other explanation regarding the small increase of area and revenue can be given by the Revenue department.

B.—Canals of Continuous Flow.

7 to 10. Are Revenue matters.

11. I am not aware of any damage having resulted from the causes mentioned.

As in this Province there is hardly one square mile of level land, no drainage is required. The water soon finds its way into the natural water-courses.

C.—Canals of Intermittent Flow.

12. Is fully answered in my memorandum, dated 20th December 1901.

13 to 18. Are Revenue matters.

19. The answer to No. 11 applies to this also.

20. Fully answered in my memorandum, dated 20th December 1901.

21 and 22. Revenue matters.

D.—Tanks.

23. Fully answered in my memorandum, dated 20th December 1901.

24 to 29. Revenue matters.

30. Fully answered in my memorandum, dated 20th December 1901.

31 and 32. Revenue matters.

33. Much inconvenience is not felt from the liability of tanks to silt up. The silt is not removed by dredging, but it is usual to raise the level of the weir.

There are no statistics as regards the depth of silt accumulation per annum.

E.—Wells.

I have given some information regarding wells in my memorandum, dated 20th December 1901; the rest of the questions can best be answered by the Revenue department.

The Public Works department has nothing to do with wells.

Oral Evidence.

1. Q. (*The President*).—You have long experience of Southern India?—Yes; 33 years.

2. Q. You were Chief Engineer for Irrigation in Madras?—I was Chief Engineer of the Public Works Department.

3. Q. Were you employed on different irrigation works?—Yes.

4. Q. You have been some years in Mysore?—Yes; 3½ years; I was there two years before.

5. Q. You give us a very interesting paper. I see in the second page of your note you give 5 series containing 1,717 tanks, of which 906 have been dealt with?—Yes.

6. Q. In Chitaldrug 105 out of 110 have been dealt with; practically this district is finished?—Yes; the series shown in my note are only typical.

7. Q. How many series there are altogether?—50.

8. Q. You give this list of the largest and most important tanks; are they separate from the series?—They are in the series.

9. Q. You say "the capacity of a unit." What is a unit?—It is ·26 of a million cubic feet. A unit is supposed to irrigate one acre.

10. Q. That allows a depth of 6 feet on an acre?—Yes.

11. Q. Do you find that useful to go by?—Yes, very useful.

12. Q. It is pretty accurate?—Yes.

13. Q. Have you arrived at a satisfactory system of keeping tanks in repair?—*No.*

14. Q. Do you see your way?—No. The rayats may be made to keep them in repair; otherwise I don't see how it could be done.

15. Q. Do you think Sankey's scheme was a feasible one to carry out?—That was for extraordinary repair; the rayats were supposed to keep them in repair.

16. Q. Do you find that they will not afterwards keep the tanks in repair?—Sometimes they do; as a rule they don't.

17. Q. Do you see any practicable way out of the difficulty?—Government could not possibly keep the remaining tanks in repair; it would be impossible.

18. Q. Is there any sort of District Board system in Mysore?—Yes.

19. Q. They do not look to the tanks?—No.

20. Q. It does not come within their jurisdiction?—No.

21. Q. You say in the third page "the table of discharges of rivers in Mysore is fairly reliable"?—I think so.

22. Q. You say "you use about 20 per cent. of the amount of water ordinarily available for irrigation"?—Yes.

23. Q. In some cases you practically use it all up?—Yes.

24. Q. As regards kudimaramat do you find the rayats pay more attention to the channels than to tanks?—No.

25. Q. We were told the other day that rayats would not repair the bunds, but would still keep their channels clear of silt?—When they find actually that they cannot get water then they clear them.

26. Q. You speak on the top of page 8 of masonry anicuts; what channels do you refer to?—The Cauvery channels; they are the only ones that the Public Works department have got anything to do with.

27. Q. The reason being that the Cauvery has a very fair discharge?—Yes.

28. Q. Talking about the establishment on the channels, on page 10 you say that "the monegars are under the Public Works department during the dry season?—That refers to the regulation of water during the dry season.

29. Q. Is there any water during the dry season?—Yes.

30. Q. What is exactly the position of Public Works department officers? Do they merely keep the channels in repair?—Yes, and they regulate the supply of water during dry months. From the time irrigation is over when the cultivation is over we take over the channels, repair them and regulate the supply of water.

31. Q. There is a kind of system of "tatils" on the channel?—Yes.

32. Q. You speak of the rules drawn up by the Governments of Mysore and Madras. The thirteen rivers referred to run into Madras?—Yes.

33. Q. That means that you must not block the supply?—Yes.

34. Q. That there might be no interference with the working, of the anicuts below. Do you find difficulty in getting leave to carry out new works on these rivers?—I have not asked permission.

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35. Q. Do you anticipate that there might be difficulties in carrying out other desirable projects in Mysore?—I think so; if we wanted to secure flood water and make a reservoir we would have to obtain the permission of the Madras Government. I don't know whether they would grant it or not.

36. Q. Have you personally, since you came to Mysore, or before, given much attention to the subject of the storage of upper waters of the Tungabhadra in the north of Mysore?—I don't know a great deal about it. There are plenty of sites on the Tungabhadra for large reservoirs.

37. Q. In Mysore?—Yes.

38. Q. They would not benefit Mysore?—They might, but it is most difficult to make a channel.

39. Q. Could an arrangement be made between the Mysore and British Governments to make a reservoir and to take up land from Mysore?—I think so.

40. Q. You are quite sure about this?—Yes.

41. Q. You only repair tanks which yield over Rs. 300 a year?—Yes; I am sure it would not be advisable for Government to repair the smaller ones.

42. Q. Are there many cases in this Province where there are tanks the water of which is not fully used?—Yes. There is the Sulikere tank.

43. Q. Do you know what the circumstances are? What prevents it from being used?—I do not know; the tank never fails.

44. Q. There is plenty of water?—Yes.

45. Q. You don't know whether this is a case of black-cotton soil?—I don't know.

46. Q. Supposing this country were unhappily to be visited by drought again as it was 24 years ago, do you think it is substantially in a better position to meet it?—I think so.

47. Q. What are your reasons?—Railways; and there is more irrigation under river channels.

48 Q. Much more?—A good deal more.

49. Q. I see you point out here on page 18 that the tanks in Kolar are no direct protection against famine?—Because the tanks are small and do not fill: they have but little water, or are altogether empty.

50. Q If there is no possibility of extending tank irrigation in Kolar, would it be a good thing to encourage wells?—Yes, to a certain extent.

51. Q. Do you believe that very much could be done by wells? Could they be extended—could they be increased in number practically without limit?—I don't think so; no; a large well in this Province irrigates about 1·3 acres: they are only useful for small areas.

52 Q. When do you expect to get your Mari Kanave work finished?—In another two and-a-half years.

53. Q It is a masonry dam?—Yes.

54. Q (*Mr Muir-Mackenzie*).—Will it always fill full?—It will very seldom fill, we will be able to cultivate in ordinary years 30,000 acres.

55 Q. Would you refuse to give water for land under the tank, because you want to retain it for next year? Would you limit the area?—No, it would be of no use because water would evaporate before next year When the tank is half full one can only cultivate half the area.

56. Q. You suggest that the rayats should cultivate according to the quantity of water in the tank?—Yes.

57 Q. Then a man with influence would take the whole water? Don't you think that he would take as much water as he could get?—Yes.

58. Q. (*Mr Higham*).—The figures given here show expenditure on irrigation works. Is that capital expenditure?—Yes.

59. Q. Do you keep a regular capital account separately?—This is an account of the amounts spent on the construction of these works.

60. Q. Are Capital and Revenue accounts kept separately?—We don't keep regular Capital and Revenue accounts.

61 Q. They really are works for which revenue accounts are kept?—Yes.

62. Q. Have you many new tanks. How do you charge them?—To revenue.

63. Q. Could you say what return on the capital cost your works yield?—No.

64. Q. All that you say is that "during so many years we spent forty-one lakhs and the revenue has been so and so"?—Yes.

65. Q. That expenditure includes not only the construction and reconstruction but also all ordinary expenses of working?—Yes.

66. Q. At page 11 you say "the assessment on areas irrigated by tanks is about Rs. 6·3 per acre"? Is that total assessment?—It is the total assessment.

67. Q. Why do you exclude mulberry and sugarcane from wet lands?—They are sometimes classed as garden and sometimes wet in revenue accounts.

68. Q. Wet lands do not include garden?—No.

69. Q. Garden cultivation includes all high class crops?—Plantains, sugarcane and karry.

70. Q. In your calculation of the amount of work you require in the case of famine you proceed on the basis that each person will earn generally Rs. 3-8-0 a month?—Yes.

71. Q. Do you take the value of the work to be done by multiplying the number of people to be employed by the quantity of work to be done?—Yes.

72. Q. Do you assume that you will get full value of work in famine labour?—No.

73. Q. If they do only half the estimated value of work you would employ double the number of people?—Yes.

74. Q. In that calculation you proceed on the supposition that every person's average pay is Rs. 3-8-0 and that you get Rs. 3-8-0 worth of work out of him?—No; we don't get that amount of work out of him.

75. Q. Out of the Rs. 3-8-0 you pay him, Rs. 2-0-0 would be the value of work he does and Rs. 1-8-0 would be extra gratuitous relief?—Yes.

76. Q. Supposing he does half a day's work you will employ twice the number of men?—Yes.

77. Q. In regard to famine relief and irrigation works you say irrigation works must be kept and proceeded with without reference to famine labour; when famine comes you would have a certain number of large works in progress which would give employment to a certain section of the population: you will have small irrigation works which the Public Works department officers will look after and you will have village works that the Civil officers will look after: and you would have road metalling?—We should have as many irrigation works as we can superintend and then road metalling.

78. Q. You would proceed with such works as you have in progress to the full extent?—Yes.

79. Q. You would not keep any in reserve for famine relief?—No.

80. Q. You would take them all up in the ordinary course?—Yes.

81. Q. In famine times you would treat the large works in the ordinary way?—As much as possible.

82. Q. You would not put people on task work?—If there is enough provision I would.

83. Q. You say "storage works, the cost of which is Rs. 100 or less per unit, are remunerative." Does that include the mere cost of storage or total expenditure?—Everything.

84. Q. That is a sort of standard you have?—Yes; there are very few exceeding Rs. 150.

85. Q. How much will a unit irrigate?—An acre on which the assessment is Rs. 4.

86. Q. Rs. 4 would pay interest?—Yes; it would give 4 per cent.

87. Q. It would not pay the upkeep?—No.

88. Q. It is quite good enough if it pays its working expenses?—Yes.

89. Q. (*Mr. Ibbetson*).—You state at the end of your memorandum that expenditure on proposed irrigation works will be 1,072 lakhs; that, of course, means that you take the capital cost on very large irrigation works?—Yes.

90. Q. At page 3 (*d*) of your replies to questions you give us the expenditure during the last ten years, on works which cost Rs. 25,000 and upwards in the three districts of Tumkur, Chitaldrug and Kolar: you have spent, it appears, in Tumkur seven lakhs of rupees wholly on restoration?—Yes.

9. Q. So that this expenditure in Tumkur should not, strictly speaking, be debited to capital cost?—No.

92. Q. Taking it as capital expenditure it works out to 1·4 per cent.? Is it not an extraordinary difference, as compared with your figures at the top of page 4 (*p*)?—Yes; I put the total expenditure in the whole Province; that *includes* the Cauvery channels and everything.

93. Q. Leaving that point you tell us that you have storage tanks irrigating some 4,000 acres and that you expect to get 3,000 new acres cultivated?—Yes.

94. Q. According to these figures you nearly double the irrigating capacity of these tanks. Do you usually expect such results from your scheme of restoring tanks?—Yes; we repair the whole tank and raise the weir, sometimes 5, 6, 7 or 8 feet.

95. Q. You expect to something like double the irrigated area?—Yes.

96. Q. You point out that if you did not restore the tanks you would lose the revenue on 4,000 acres?—Yes.

97. Q. Your restoration brings in only something like 1·4 per cent.?—Actual restoration.

98. Q. It is not a paying business?—No.

99. Q. In the Kolar district you give three new works. They were finished three or four years ago and they pay one per cent., half per cent. and 9 per cent.?—Yes, we had had

years since they were constructed; I don't know about the tanks; they cost about Rs. 150 per acre.

100. Q. Have you any older tanks in Mysore of which the capital cost is known?—There must be some.

101. Q. You don't know which they are?—No.

102. Q. Do you know whether any one could give us these figures?—No.

103. Q. (*Mr. Rajaratna Mdlr.*).—On page 12 you say, referring to the rule passed in October 1873, that the rayats should maintain their tanks. Do you know if that rule is in force?—Yes.

104. Q. If it has been in force what is the difficulty in keeping the minor tanks in order?—Because it is not always enforced; it is enforced sometimes; but as a rule the bunds are allowed to get lower and lower till there is a breach.

105. Q. If the rule were enforced there would be no difficulty in keeping the tanks in order?—No, if it could be enforced.

106. Q. Do you think that the rayats would be induced to keep the tanks in order if remissions were granted in seasons when the crops failed owing to the failure of water-supply?—I don't think it would have any effect.

107. Q. If remissions were granted when there was a failure of supply, but refused if this duty was not carried out?—I don't think so.

108. Q. Supposing a certain percentage of assessment is remitted subject to the condition that the tanks would be kept in order—would they be induced to do the necessary repairs?—How are you going to make them keep the tanks in order.

109. Q. It would be something like the old dasalwandum remission. Under that system persons who kept their tanks in order were granted certain remissions of revenue; if that duty was not performed the remission was withheld?—I don't think it would have any effect; they know if they don't do it it will be done by Government.

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110. Q. Supposing 20 per cent. were remitted from the assessment?—I don't think it would be any good.

111. Q. Even that will be no inducement?—No.

112. Q. On page 20 you refer to some sites in the Mysore territory which were selected for the Tungabhadra reservoir: do you think that any large area will be submerged?—A good deal; forest reserves will be submerged.

113. Q. There would not be loss of revenue to the Mysore Government?—I don't know; I have not seen the sites myself; but I think that on those sites a greater portion of the area would be forests and jungles.

114. Q. (*Mr. Nicholson*).—Are these tanks in Mysore chiefly in chains?—Yes.

115. Q. That being so is it possible generally to raise the bunds and weirs of tanks without causing either loss of water to the tanks below or submerging the land above?—It must submerge the land above.

116. Q. How? Submerge the cultivated land above?—Yes.

117. Q. Benefit to one land is often carried out by the loss of land to the tank above?—Generally there is dry cultivation; the cultivation from the tank above does not come down to the waterspread of the lower tank.

118. Q. Are you not met with the objection that by enlarging a tank you cut off the water-supply of the tank below?—We always calculate how much water is available.

119. Q. You were asked what were the basis of the statistics as to the value of all cultivated crops on page 14; it is from official records?—Yes.

(Witness withdrew.)

THIRTY-FIFTH DAY.

Bangalore, 20th January 1902.

WITNESS No. 39—Mr. W. McHUTCHIN, Superintending Engineer.

Mr. McHutchin.

20 Jan. 02.

Written Evidence.

[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. Whole Province; connected with Mysore Public Works Department, with brief intervals of absence in Bengal and in England, since 1874.

2. Rainfall registers annually issued by Meteorological Department give this information. In the cases of the Shimoga and Kadur districts it would be better to keep separate averages of the rainfall in the Malnad and Maidan areas respectively.

3. (1) Yes; and perhaps more especially so in the tracts most subject to drought, viz. Chitaldrug and Taluks adjoining that district in the Tumkur, Kadur and Shimoga districts; and some limited areas eastern and northern parts of Kolar. It is only natural that places where the rainfall is most uncertain and precarious should be the most thinly-populated.

(2) & (3) No information at first-hand.

(4) There are localities of limited area in several districts of the Province where soil is unsuited for irrigation; but so far as my knowledge goes there are no *very large* tracts of such soil (generally due to salt efflorescence).

I have seen many localities in, I think, nearly all the districts of the Province where the soil under some of the tanks is in part at any rate "black-cotton," and on which good wet crops are grown.

(5) The uncertainty of water-supply to tanks owing to deficient rainfall is of course a normal state of things all over the Province; with the exception of the Malnad belts on the west and south-west, and the narrow belts of wet land under channels from the Cauvery and Tungabhadra and their feeders.

(6) to (9) No information at first-hand.

4. & 5. Ditto.

6. I have had no experience of any injurious effects from extension of irrigation. In the Province as a whole there are numerous petitions received praying for construction of such works, and extension and improvement of existing work.

B.—Canals, etc., from Table of River Channels.

7 to 11.—Irrigation works in this Province being under the control of Revenue Department, I can give no information at first-hand on questions Nos. 7 to 11.

These river channels are annually cleared by Public Works Department at present.

C.—Canals of Intermittent Flow and Tank Feeders.

12 to 19.—No information at first-hand.

20. These channels are supposed to be maintained by the rayats; but as a rule are allowed to deteriorate in a very short time after being restored by Government. Legislation of some sort certainly very necessary.

21. & 22.—No information at first-hand.

D.—Tanks.

23. (1) In nearly all cases throughout the Province by rainfall. There are a few tanks fed by flood-water canals, chiefly in Tumkur, North Kolar, Mysore, Kadur, Shimoga and Chitaldrug districts.

(2) Ordinary channels with pipe, or masonry sluices.

(3) & (4) It is impossible, I think, to answer these questions when dealing with the whole Province. Conditions materially differ in different districts.

24 to 29. No information at first-hand.

30. Legislation is certainly very necessary to prescribe rules for repair and maintenance of tanks.

31. & 32. No information at first-hand.

33. Many of the old tanks have been breached and abandoned in consequence of silting up; especially in black soil country.

I do not think any statistics have been kept of the rate of silting. It is our practice, in cases where tanks have silted up considerably, to still further raise the bund.

It is my opinion that, taking into consideration the large area as a rule which it would be required to dredge, it would be cheaper, unless compensation for submergence is very high, to raise the bund than to dredge. In some localities rayats do use tank silt dug out from dry beds of tanks for manuring their fields.

E.—Wells.

No information at first-hand.

Mr. McHutchin.

20 Jan. 02.

Oral Evidence.

1. Q. (*The President*).—You are Superintending Engineer in this Province?—Yes.

2. Q. You know the whole of Mysore thoroughly well?—As Assistant Chief Engineer some years ago I went over most of it.

3. Q. You say in your memorandum "I have seen many localities in, I think, nearly all the districts of the Province where the soil under some of the tanks is in part at any rate 'black cotton' and on which good wet crops are grown." Do you feel that you would be influenced in constructing a tank by the fact of there being black-cotton soil below it?—I should be disinclined to build a tank if there was nothing but black-cotton soil below it.

4. Q. Is there any feeling here that juar is injured by being irrigated?—No, it is better under irrigation, in the dry parts of Mysore juar is very poor as a rule, it is generally grown in sandy soil.

5. Q. Perhaps it is partly due to the soil?—The best soil as a rule is under the tanks

6. Q. You say "these channels are supposed to be maintained by the ryats, but as a rule are allowed to deteriorate in a very short time after being restored by Government. Legislation of some sort is certainly very necessary"?—That is with reference to channels that are not maintained at Government expense.

7. Q. You say further on "legislation is certainly very necessary to prescribe rules for repair and maintenance of tanks" What form of legislation is necessary do you think?—It is a very complicated subject; I wrote a long note on it some years ago, it would have to be decided by a Committee of Revenue and Public Works officers; what we should like to propose Revenue officers would object to.

8. Q. With your long experience and knowledge of the ryats, what do you consider would be a reasonable policy; of course in a matter like that one cannot take a merely technical view?—It is a question of custom in Mysore under the old Rajah, they repaired and maintained their own tanks; that custom has fallen into disuse.

9. Q. Would you propose to legislate that statutory labour should be imposed in future?—If we relieved them altogether there should be an extra assessment; the ryats' obligation should not cease altogether.

10. Q. There is a tank cess?—There is an irrigation cess, that has I suppose to go to the repair of tanks when they are breached, but not for annual ordinary repairs.

11. Q. How much is it per acre?—It is one anna in the rupee

12. Q. (*Mr. Ibbetson*) - Is that on small tanks as well as big?—I think so

13. Q (*The President*).- Would the case be met if the assessment was so increased as to cover all repairs?—I think the ryats would rather have increased cess than do it themselves.

14 Q. Do you think Government could easily command machinery for doing it? It is difficult, especially when a tank is in sudden danger

15. Q. Would it do to give the villagers the choice either of keeping their tanks in order or of paying additional cess?—The Government of Mysore are trying in some cases in Chitaldroog to relieve the ryats of this maintenance by fixing some rate of assessment, but how this has answered I cannot say, it is not in my circle; perhaps the Deputy Commissioner of Chitaldroog might be able to tell you, or Mr. Karve.

16. Q. You say in reply to question No. 23 with regard to tanks: (1) "In nearly all cases throughout the Province by rainfall. There are a few tanks fed by flood water canals, chiefly in Tumkur, North Kolar, Mysore, Kadur, Shimoga and Chitaldroog districts." Can anything more be done than has been done in the way of connecting tanks with rivers?—Very little I think except on the Cauvery and Tungabhadra; they are really dependent entirely on rainfall; you would have to construct new ones.

17. Q. But still if it could be done the tanks would fill better?—Yes; but most of the rivers which could be utilized have already been utilized; we have restored several of the old anicuts.

18. Q. In the course of your experience can you recollect any tank that has become absolutely silted up that formerly did duty?—I cannot remember any tank having silted so entirely as to be useless. There are old tanks that have breached, this is most common in the black soil country.

19. Q. This is due to the black soil washing off quickly?—Either that or the streams carrying a tremendous lot of silt.

20. Q. You have formed no estimate of the life of a tank on the average?—No; probably in 30 years in the ordinary red soil we would have to raise weirs a foot, that is in a chain of tanks.

21. Q. Have you known in any circumstances a tank cleared of silt by labour?—No.

22. Q. Not in the times when relief was required?—No; the ryats do take a little of the silt now and then for their fields, but it does not make much difference.

23. Q. I have a paper by the Deputy Commissioner of Tumkur, in which he mentions the following works: (1) Shimoga project, (2) right banks channel of Baram Kanava dam, (3) Javagondanahalli project, (4) Honnamachanahalli new tank, (5) Heggadahalli tank, and (6) Tumbadi tank?—The Baram Kanava right bank channel was advocated and it was abandoned because it was all jungle; there is no population; it would be cheaper to build an anicut lower down and utilize the water there where it would be more appreciated.

24. Q. There is water there?—I don't think the tank has been fully utilized since being built; but I don't know it well, it is not in my circle.

25. Q. You remember the old famine: do you think that Mysore is in a materially better position to withstand another famine?—I think so, much better; not only from railways but we have done a great deal in the way of improving old tanks and channels.

26. Q. (*Mr. Muir-Mackenzie*).—Still the tanks would go dry in the famine altogether?—Yes, excepting those that are river-fed.

27. Q. (*The President*).—Have you improved them?—No, excepting the head works.

28. Q. Have you heard of putting up water-tight puddle trenches across the bed of a stream to check under-ground flow?—No, I have not seen that: they simply utilize what is flowing in the stream.

29. Q. What about big reservoirs in the hills?—We looked for some sites on the Cauvery catchment; one or two are being investigated, they may be possible; on the Tungabhadra they would not be of much use to Mysore.

30. Q. Are there any that would be of use to Mysore?—The Shimsha dam would be useful.

31. Q. Is that a big work?—Yes, we have probably 15,000 suits available there.

32. Q. (*Mr. Muir-Mackenzie*).—Is that on the Tunghabhadra?—No, on a tributary of the Cauvery which joins it below the falls.

33. Q. (*The President*).—Would Mysore get any good out of the Lakvali site?—We should only be able to cultivate a narrow strip owing to the vicinity of the hills, it very soon joins the Tungabhadra.

34. Q. You could not divert it by a high dam to the right?—No, the water sheds are very high; it would be useful if we had anicuts below with short channels; a big reservoir would not pay at all; we would have to swamp most valuable teak forests.

35. Q. You say that the country is being examined?—Mr. Karve has gone round with a view to a preliminary investigation.

36. Q. If you could get a first-class site it might be worth while sacrificing valuable land?—On the Lakvali we have not land commanded by it in sufficient quantities.

37. Q. I suppose you have had a famine-relief programme prepared?—Yes, but the projects entered in it have not been estimated for yet; it is a question whether we should estimate for most of the reservoirs; because by the time the famine came there estimates would have to be done over again, unless they are new reservoirs.

38. Q. Yes, of course, that is a part of the theory of a famine programme that you have always to be ready?—Yes; I believe a great deal in roads and railways.

39. Q. You have a pretty thorough net-work of roads in Mysore, have you not?—Yes; new irrigation works would be dangerous to construct, unless they are carefully supervised.

40. Q. (*Mr. Higham*).—With reference to the Lakvali tank, I understand you to say that there is not enough land in Mysore territory to be served by it?—No, we have not; we have not taken actual levels; certain levels have been taken for the anicut lower down, we know what it commands; we should soon get into rocky hills which are quite unculturable.

41. Q. Has the catchment area of that tank been determined?—I think it is about 700 square miles.

42. Q. Then it would hold, I suppose, a large volume of water?—Yes, the rainfall is about 125 inches.

43. Q. And would be certain to fill?—I think so.

44. Q. A tank of that sort might be of great service to the Tungabhadra lower down in British territory?—I think so.

45. Q. Supposing such a thing were proposed, it would benefit a certain area in Mysore as well?—Yes, and it would also command a certain area in the Chitaldroog district, but that is black soil and whether the ryats would use it on black soil I cannot say.

46. Q. I suppose most of the area that would be served would be in a country where the rainfall is pretty abundant?—In Mysore it would be 30 inches in the tract that would be served.

47. Q. That would be liable to drought sometimes?—Sometimes, but only small portions of it, not the whole of Shimoga and Benkipore.

48. Q. As regards the Lakvali, would you swamp much wet cultivation, or rice in the villages? Are there many villages?—Not many; there are valuable *supari* gardens: we have never had the waterspread surveyed.

49. Q. It is in the midst of jungles?—The greater part would probably be forest.

50. Q. Are these forests very valuable?—Yes, they are the most valuable teak we have.

51. Q. Do the people here always put manure on their land when they irrigate it?—I think invariably.

52. Q. Is that for tank irrigation or for irrigation of all kinds?—On river channels they use a good deal of manure: they sow grain and plough it in.

53. Q. On all these tanks there is land revenue assessment and no water-rate at all? I think there is a water-rate fixed on all our new works.

54. Q. When is that applied?—When new land is brought under cultivation.

55. Q. That is only applied to new lands to which irrigation is applied for the first time?—I cannot say how they apply it, I think it includes a water-cess. From Rs. 3-8-0 to Rs. 5 is what they pay under tanks; if the tank breaches I think they pay 12 annas. Rs. 2 is the charge for dry crops; the rest you may take as a wet rate.

56. Q. If a tank breaches do they reduce the rate?—I think so.

57. Q. When people want water from a tank, do they have to apply to anybody and state what area they require it for, &c.?—Directly we restore a tank it is handed over to the Revenue Department, we know nothing further about it, the Revenue Department settles who is to have the water and all such points.

58. Q. Do you know if they have to send in applications for every crop?—I cannot say.

59. Q. Do you ever have cases in which water is left in a tank at the end of the irrigating season and carried on to the next year?—No, I think they always irrigate if they can, unless the supply is small and they think they cannot get a material area cultivated, they grow a dry crop then; if they have a small supply they require it for cattle.

60. Q. There is never any attempt to hold water in reserve?—They hold it in reserve for dry weather crop in some parts they don't grow rice in the ordinary time of the year, they plough in January and February and reap their crop at the beginning of the monsoon.

61. Q. Do the people do it by preference?—They prefer it, they seem to get a bigger outturn: that is particularly noticeable in the Kadub tank in Tumkoor district: they cultivate in the hot weather.

62. Q. In what months of the year?—They begin to plough in December and reap it in the beginning of June; I have seen them ploughing in December and putting the crop down.

63. Q. (*Mr. Muir-Mackenzie*). What crop?—Rice; they don't seem to care about irrigating it in the ordinary season, I don't know why.

64. Q. Is that peculiar to that part of the province?—No, but I have seen it particularly there.

65. Q. (*Mr. Rajaratna Mdlr.*).—There is no second crop?—Most of it is vy-sack; they get a better outturn.

66. Q. (*Mr. Higham*).—They don't take water till December?—No.

67. Q. Do you think it would be desirable in case you have more water than you require to carry it to the next year or extend irrigation in the present year?—They would lose by evaporation; in some cases they could get two crops, as a rule the tank only holds enough for one.

68. Q. The tank is empty by about April?—Yes, or there is not enough for another crop.

69. Q. You say "legislation is certainly very necessary to prescribe rules for repair and maintenance of tanks." I suppose the great objection to Government undertaking repairs is that they could not look after so many tanks?—Yes, there are too many, including these minor tanks.

70. Q. Whatever legislation there is must be in the direction of compelling the people to do it themselves?—There might be some arrangement in the case of smaller tanks being placed under district officers, but I think, personally, it would be a mistake, it would be very difficult to look after them, the rayats would not take so much interest in them.

71. Q. Have you any idea what form legislation should take in the matter?—We have got a minor Tank Restoration Scheme and certain rules that we issued in 1873, but I think the Revenue officers find it difficult to enforce the maintenance of the tanks, there are many absentee rayats who own land and don't live on the spot and who won't do their work.

72. Q. Would it be possible if a tank is not kept in repair to give a man notice that Government will repair it and recover the cost?—That is our rule nominally, but they are very often let off, Government repair it and don't recover cost; in some cases we do.

73. Q. Do you ever recover more than the cost?—No.

74. Q. Not as a penalty? No, that would be a very good rule if you could enforce it.

75. Q. Would you propose to charge them more than the cost of repairs if Government undertook it?—No, I don't think it would be necessary.

76. Q. If you didn't do anything of the kind, nobody would repair the tanks until they received notice?—I don't know, it would have to be tried; it is a difficult point to legislate upon; the only thing I can think of is a committee to thrash out the subject.

77. Q. Have there been any definite proposals made?—Not since 1873.

78. Q. You say when tanks are filled up, they often allow the bunds to breach and they remain breached?—The old tanks breached; if any tank of large size is breached it is generally restored.

79. Q. If it is silted up very heavily, you leave it as it is?—Yes.

80. Q. I suppose the land above the bunds is valuable?—Yes.

81. Q. They could grow dry crops on it?—Yes.

82. Q. Does the silt get washed out? Generally the breach is a deep nala.

83. Q. The silt remains?—The silt washes into a ravine and a large amount is brought down.

84. Q. The silt formerly deposited does not get scoured out?—No, it becomes a good grazing ground for cattle.

85. Q. I suppose there is some limit to the extent to which you can raise bunds?—If we raise the bund we deprive the tank below of water: nearly all our tanks are in a series.

86. Q. If you raise the bund *pari passu* with the bed silting up, the tank does not hold any more water than it originally did?—No, but if you were to raise the bund a foot to cultivate the same area as before, the ryots below would then immediately complain.

87. Q. They would complain because they would not be quite so well off as before?—Yes, naturally.

88. Q. You say the only tanks that can be fed from rivers are those that might be fed from the Cauvery and Tungabhadra?—No, there are a few streams at the end of series of tanks, where there is a certain amount of tail water especially in the case of the Vedawatti which could be utilized again.

89. Q. Do you have as many as fifty tanks in a series?—There are 1,000 on the Ramasagar series.

90. Q. In dry years the lower tanks get no water at all?—The last but one, the Belmunga, has a good catchment of its own and fills better than any other.

91. Q. How?—It has got a good free catchment.

92. Q. That is exceptional, in the other cases the water fills higher up and then passes on to the next?—The top of a series gets more water per square mile.

93. Q. If there is short rainfall the lower tanks in a series would suffer?—Yes, they would.

94. Q. Whatever rainfall there was would go into the upper tank?—Yes, they have a separate catchment in the upper tanks; they generally use twice as much as they require and that passes down.

95. Q. Does the lower tank ever get no water at all?—If the upper tanks don't fill the lower ones would be no better off; in ordinary years they get partly tail water and partly the supply from their own catchment.

96. Q. As a matter of fact it never happens that the lower ones don't get water?—They are no worse off than the upper ones.

97. Q. The upper ones would not pass water on?—If the tanks are constructed in the proper way and if there are not too many of them they all receive about the same supply; they have all got their own free catchment.

98. Q. But there may be no rain in the lower catchment?—That seldom happens, in the annual rainfall statement all over Kolar it only varies from 24 to 28; it is pretty uniform all over the country.

99. Q. Except, of course, on the ghâts?—There we depend on the south-west monsoon.

100. Q. I believe it is now twenty-six years since you had famine here. I suppose you have no collections of road metal?—No.

101. Q. If you had another famine a certain amount of road metal would be more useful than otherwise?—Yes.

102. Q. You talk about railways being a good thing?—Railway embankments.

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103. Q. That depends on whether a railway is going to be built?—Yes.

104. Q. Have any railways been proposed?—One or two in Kolar; they are feeders.

105. Q. I suppose in Mysore Railways would give more earthwork than in most other parts of India?—Yes, on account of the succession of cuttings and banks; there is very little level country.

106. Q. There are only two at present proposed?—There is the Arsikere to Mangalore, there are two in Kolar and the one from Nanjangode to Erode.

107. Q. Have these been surveyed?—Yes, and estimated for.

108. Q. Then they would be really available for work?—Mr. Groves has just sent it in his estimate; the Government of India have it.

109. Q. Would that go through a famine tract?—As far as Hassan. There is a branch proposed from Mysore to Mercara, that would also go through a famine tract.

110. Q. (*The President*).—You have spoken of sites for reservoirs in Mysore only: are there any sites in British territory that would be of use in Mysore?—Only a very small portion of British territory in Coorg and a little bit in Madaksira elsewhere the Madras Presidency does not command Mysore.

111. Q. (*Mr. Ibbetson*).—You said just now that you would be disinclined to build a tank if there was black soil below it, because you would not be sure of the people taking water: would the depth of the soil and nature of the substratum affect your decision at all?—Yes, in Mysore we have very deep black soil. There is a sort of salty excrescence; when you give water the natives don't use it.

112. Q. That is generally the case with black soil in Mysore?—In Kadur they cultivate black soil a great deal.

113. Q. And irrigate it?—Yes.

114. Q. What is the depth there?—It is from about 5 to 9 feet; I don't know that it is genuine black cotton soil; I don't know the analysis of it.

115. Q. Do you know what is below it as a rule?—Sometimes sand: it is generally decomposed granite.

116. Q. Is that permeable to water?—Not generally.

117. Q. Do they irrigate freely in that tract?—Yes in Kadur, if they have water.

118. Q. Do they use what water there is?—Yes.

119. Q. Have you noticed that the irrigated cultivation there is is of a higher class than elsewhere and that it is more manured?—No, I cannot say that I have.

120. Q. You have not noticed it?—No, they grow rice and also currystuff, vegetables and wheat which require water but not to such an extent as rice.

121. Q. (*Mr. Muir-Mackenzie*).—Is cotton grown in dry lands in that vicinity?—There is very little cotton in Kadur; in Davanagiri and Chitaldroog they grow cotton.

122. Q. (*Mr. Ibbetson*).—Would you say that the irrigation cess from which the larger repairs are done is 1 anna on the rupee?—Yes.

123. Q. I suppose it is 4 annas an acre on the tanks?—Yes, it is not more in the red-soil country.

124. Q. Are you limited for your repairs to that cess?—Yes, as a rule, unless Government give us a special grant.

125. Q. As a rule that does cover it?—It covers only the repairs on small works.

126. Q. Supposing that the whole of the repairs were taken over, that is to say petty repairs, how much do you suppose you would have to increase that cess?—Four annas an acre more, that is to say double it; in some parts where tanks are liable to damage perhaps eight annas more.

127. Q. In those parts where you would require eight annas they pay a low assessment?—Yes, I am talking of Chitaldroog.

128. Q. So that the cost of these repairs would probably be something like two annas on the rupee?—It probably would.

129. Q. Speaking about legislation and the difficulty of enforcing this liability for petty repairs, you said that many owners are absentees; would it not be quite fair to make the tenant responsible for the repairs, he has to pay his rent whether he gets his crop or not, it is to his interest that the water-supply should be given?—I don't know the terms of his agreement.

130. Q. Do you see anything unfair in that?—No; I think it would depend on the agreement with his landlord.

131. Q. Compensation for submerged land is a considerable item in repairing tanks or making new ones?—Yes.

132. Q. Do you see any objection to such land being left the property of the man who owns it with liberty to cultivate it when the water recedes, reduced compensation being given to him?—I think it would be a mistake to have cultivation as a rule there.

133. Q. Why?—Because it has a tendency to silt up the tank.

134. Q. Do you forbid all cultivation?—In ordinary years it is forbidden.

135. Q. Have you any experience which would enable you to judge how far the prohibition is necessary? How far does cultivation really contribute to the silting up of the tank?—I cannot say I have had any personal experience of the fact; it is a very good thing to have little gardens above the tank to hold up the silt.

136. Q. Have new tanks been made in your charge of which the capital cost is known?—Yes, some in Kolar.

137. Q. Do they pay?—They have not paid at all well, because the tanks are in a dry tract and have not filled well; they may pay 3 to 4 per cent.

138. Q. Is that because you have had dry years lately?—I think the tanks were built as famine protection.

139. Q. Do you think they will ever pay fairly well?—No.

140. Q. Will they pay working expenses?—Yes.

141. Q. Have you got any new tanks in better tracts?—Yes, a good many.

142. Q. How do they pay?—The Borankanuva which has a masonry dam has not paid at all; that is due to the unhealthiness of the district, the paucity of population and the land not being suitable.

143. Q. Do they take water?—For 500 to 600 acres: we have not completed it.

144. Q. Are there any tanks of which you know the cost; I mean are there any which you calculate pay on the whole cost?—I think most of them pay; if you deduct what it costs to bring the tank to its original level then you would get a return of 5 to 6 per cent.

145. Q. You are speaking of the restoration of tanks?—Yes.

146. Q. I am talking of the whole cost?—There are several in S.—which I have not seen completed.

147. Q. Are they paying?—No.

148. Q. As regards the construction of new tanks, it does not seem probable that they will pay Government?—They will probably pay 4 per cent. on red soil.

149. Q. Have you any instances of tanks paying that?—(Not recorded).

150. Q. You have very little room for new tanks?—Yes.

151. Q. Is that because there are no physical sites available or is the water used up?—All the best sites have already been selected as a rule.

152. Q. When your present tanks silt up would it be better to clear them or build new ones?—As a rule it would be better to raise the bund.

153. Q. But when the tank is dead?—We have not many sites for new tanks.

154. Q. The actual sites are very few?—Yes.

155. Q. Have you many private tanks?—I should not think there were many.

156. Q. How are they kept up; are they in fairly good repair?—The few I have seen are not kept up.

157. Q. Do you repair them?—We don't as a rule unless we are asked to do so; if a Government tank is in danger we do the repairs.

158. Q. Have any private tanks been made in your time?—No.

159. Q. So that the rule regarding the grant of a quarter of the revenue to a man who makes a tank has not worked so far?—No.

160. Q. (*Mr. Muir-Mackenzie*).—Do you know anything of the Madag tank in the Dharwar district?—Yes it is on the frontier: I don't know if there is any surplus from that tank; it would fill in an average year but not in a dry year; it had not filled for two years when I saw it; the catchment is 521 square miles.

161. Q. It does not depend on such a certain large rainfall that it would fill every year?—It is not subject to drought; but they don't get more than 30 to 40 inches.

162. Q. Is there any strong objection to giving up the land for its enlargement?—I cannot say.

163. Q. The catchment is in Mysore territory?—Yes, the tank is on the frontier of the province.

164. Q. (*Mr. Rajaratna Mdlr.*).—Under the rules in force in Mysore you can employ coolies if the rayats neglect to send them and recover the cost?—That is the rule.

165. Q. If it is properly enforced how does the absence of the landlord from the village cause difficulty?—If it was properly enforced tanks would not deteriorate; I have to assume that the law is not enforced.

166. Q. How does the absence of rayats from the village cause difficulty if the law is enforced?—If we were allowed to carry out the work at the rayat's cost there would be no difficulty.

167. Q. The law allows it?—I don't know if it is the law.

168. Q. You can recover as arrears of land revenue?—That is the rule nominally; I don't know if it can be enforced.

169. Q. If such a law existed the absence of the rayats would not cause difficulty, would it?—I don't know if the Revenue Department can recover the cost.

170. Q. There are no instances to your knowledge of the rule having been enforced?—No, there has been a resolution by Government but I don't know if it has been made law yet.

171. Q. How many tanks are there in your circle and what is the area ordinarily irrigated?—I have a list of only the major tanks; I think there must be probably about half in the Western and half in the Eastern Circles; these are supposed to be 40,000, but many of them are small and insignificant; as regards irrigation tanks I think there are probably 20,000—10,000 in Mysore and 10,000 in the Eastern Circle.

172. Q. How many have been repaired in the last ten years?—I can only tell you the larger ones; the smaller ones are done by the rayats under the Revenue Department.

173. Q. You refer to tanks in which bunds have been raised. I suppose these are tanks that have been repaired by the Public Works Department?—I referred to those we had restored. *Mr. McHutchin.*

174. Q. Are there many cases in which you increase the capacity when restoring the tank?—As a rule we raise them to the original capacity; there are instances also in which the original capacity has been increased very much more. 20 Jan. 02.

175. Q. In such cases has there been any submergence of existing cultivation?—Sometimes there has; as a rule we don't raise those tanks that submerge valuable land.

176. Q. Where new land is submerged you pay compensation?—Yes.

177. Q. Are remissions granted?—We don't collect the revenue; I think remissions are granted for areas that don't get water, I cannot say positively.

178. Q. If an irrigation cess is imposed in the manner you propose, raising the present rate to two annas in the rupee, don't you think it would be proper to grant remission of assessment in such cases?—I think so.

Witness No. 40—Mr. C. T. Dalal, Superintending Engineer.

Written Evidence. *Mr. Dalal.*

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[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. The answers under Canals of Continuous Flow refer to the river channels of Mysore and Hassan Districts. I was Superintendent of these channels from 1875 to 1881. The answers under Canals of Intermittent Flow, tanks and wells, refer to the Tumkur District. I was Executive Engineer of this district from 1881 to 1898.

2. Average rainfall of Mysore, Hassan and Tumkur Districts for each month of the year for the last 25 years is extracted from the Meteorological Report and given below:—

Month.	Mysore.	Hassan.	Tumkur.
January	0·08	0·02	0·03
February	0·08	0·07	0·06
March	0·44	0·33	0·19
April	2·05	2·13	1·39
May	4·86	3·83	2·93
June	2·01	4·13	2·52
July	1·85	7·04	2·46
August	2·73	4·17	3·00
September	4·32	4·07	5·63
October	5·86	5·74	5·22
November	2·44	2·59	2·16
December	0·50	0·59	0·39
Total ..	27·22	35·81	25·98

3. There is no obstacle to the extension of irrigation on account of—

(1) Sparsity of population. If population is sparse in the commencement, people come from villages where there is no irrigation, and all the lands are taken up within a few years, if the area is small. For large areas it takes 20 years or so.

(2) There are strong cattle in the country. When water is made available for dry lands, stronger bullocks will be bought. In some cases Government will have to give Takavi to do so.

(3) Manure is enough for irrigated rice, as Honge and other leaves are used for the purpose. They are made to rot in the field and thus supply manure. When I proposed to utilize water in some tanks in Sira Taluk for irrigation of dry crops, the rayats said that for this kind of crop, lot of cattle manure was required and it was costly and difficult to get. This is the cause assigned by rayats for not taking to irrigation of dry crops under tanks in the Tumkur District. I personally think that they like to put in rice instead of dry crops under tanks, because the net profit from an acre of rice, after deducting cost of cultivation and Government assessment, is much more than from an acre of dry land.

(4) Soils met with in Tumkur District are generally fit for irrigation. There is no black-cotton soil.

(5) This applies to tanks only and not to channels with continuous flow or even channels with intermittent flow. As long as tanks fill in at least six years out of ten, the rayats will take up lands for irrigation under them. If a tank fills early, the rayats put down the Karteek (Khrif in Northern India) rice crop. If it fills late, the rayats put in the Vaisak (Rabi in Northern India) crop. Both crops are of rice only. If the tank fills half, there will not be water enough for all, and as all wish to irrigate their lands, the water is allowed to evaporate and go to waste, and all the lands lie fallow. Many tanks have rice and arecanut gardens under them. These gardens take water when there is water in tank, and from wells after the tanks dry.

Vaisak or Rabi rice crop is generally put after the tank fills. It gets the benefit of March and April rains. As said above, when a tank is half full, water is not made use of Some rules are urgently required to determine what lands should be irrigated, and which should lie fallow, when a tank is only half full. Karteek crop alone is put under small tanks as water in them will not suffice for Vaisak. It will be a good thing if the beds of these small tanks are cultivated for dry crops in the dry season whenever feasible, and the revenue derived from each tank specially reserved for the repairs of that tank.

(6) There is no obstacle. The rayats do the work themselves and can bring under irrigation all the new lands for which Government can supply water in ten years at most. In this period they will prepare the land with their own labour without having to spend any money in cash.

(7) Tanks only.—Cultivation under tanks is more or less a lottery, as the tanks may fill or not. Even if the tank does not fill and no crop is got, assessment has to be paid. The assessment is the average of good and bad years. The actual cultivators do not care to take the risk as a rule. The wet lands are therefore held by the richer cultivators and non-agricultural classes, while the dry lands are generally held directly by the actual cultivators. If higher assessment is recovered in years in which a crop is raised and remissions given in bad years, the cultivators may take up irrigated lands under tanks themselves.

(8) This is a question for Revenue Officers.

(9) Tanks only.—Amongst other reasons that work against the extension of irrigation, I beg to state the following:—

New irrigation works are constructed by the Public Works Department and main channels cut and handed over to the Revenue Department. It necessarily takes some years before all the dry lands are taken up for irrigation, or it may be that the tank may not fill for a year or two after it is completed, and in the meantime the channel gets silted up. The Public Works Department refuse to clear the channel as it is already done and handed over, and the rayats refuse to clear the channel and irrigate the lands. The question is allowed to slide and is lost sight of amongst other matters. The tank channels are supposed to be maintained by rayats, and they are without exception neglected. Water goes as far as it can in spite of neglect, and cultivation becomes less and less under the main channels. The waste water is picked up by small dams across the surplus or weir channels. Some of these *anneys* or dams are permanent and some are of mere earth and washed away when weir discharges.

Wastage from upper tanks is utilized in the lower ones when tanks are in a chain. But in the case of terminal tanks the wastage is irrecoverably lost.

I would maintain, by Government agency, channels and *anneys* of all tanks yielding more than Rs. 4,000 annually and terminal tanks even if they yield Rs. 1,000. A cess to be recovered from the lands to be benefited and kept at the credit of that work. A permanent committee of three men selected every five years by rayats to do the work by *amany*, without waiting for sanction, as long as there is money at the credit of the work.

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Channels of all new tanks (including tanks breached long ago and lately restored) should be maintained at Government expense till cultivation comes up to the intended or possible limit. In the case of new tanks I would cut catch-channels to intercept the waste water before it falls into the weir channel somewhere half-way. If it is caught like this we can get much more irrigation from a given quantity of water than is now done.

4. & 5. These questions are to be answered by Revenue Officers.

6. Extension of irrigation does not tend to injure the remaining cultivation, at least not for a long time: I believe one helps the other. In the case of big tanks, the rayats cultivate the dry lands in the rainy season and the wet lands in the dry season. The rayats thus get employment when they are free. The rayats throughout the Tumkur District are anxious to increase means of irrigation, but we cannot do this to any large extent.

There are only a few sites left for new tanks. There is no permanent river in the district, and as for wells, Government have done as much as is possible.

B.—Canals of Continuous Flow.

The remarks given below refer to the river channels of Hassan and Mysore Districts.

7. I cannot give a complete answer to this question. It is for the Revenue Officers to do so. I was in charge of these channels in the great famine of 1876-78. The rayats holding lands under the channels even then got the same supply of water as they did in ordinary years. Famine did not affect the area under these channels at all. Rice crop is put in the rainy season under these channels. In the dry season (December to June) water is let for seven days every month in the channels. It irrigates the sugarcane, and pulses which are put on some of the lands. The pulses are put more for manure than for crop.

8. to 10. These are for Revenue Officers to answer.

11. The Mysore lands have generally good slope, and are naturally well drained There is no water-logging efflorescence to talk of.

General.

As yet we have made use of only the perennial supply of the Cauvery and its tributaries. A very large quantity of water goes to the sea in the rainy season in the main river and its tributaries, the chief of which are the Hemavati, Yegchi, Lakshmanteertha and the Kabani. We ought to store the flood waters by constructing reservoirs and feeding them with flood waters. An *anney* can feed a series of tanks one in each valley as shown in sketch in the margin. A similar chain of tanks can be put on the opposite side of the river. This can be done only where we have not got channels already existing.

C —Canals of Intermittent Flow.

The remarks below refer to the Maddagiri and Pavagada Taluks of the Tumkur District. The other six taluks have no channels of this kind.

In these two taluks run the Jayamangali and the Penner Rivers. The soil of the two taluks is sandy. The tank beds are filled up with sand 5 to 20 feet deep. The waste weir channels are also full of sand 8 to 10 feet deep. The sand in the tank bed and the sand in the waste weir channels and the sandy ground of the whole country generally absorb a large quantity of the rainfall of the year, and yield it again if wells are excavated or deep channels cut.

There are two groups of channels. The first is the channels taken out from the Jayamangali and Penner. These rivers contain a little of running water from September to February. In other months there is no water running on the sandy bed.

The bed of the channel at head is generally cut to the level of bed of river. Water is thus diverted to it by a small bund of sand. In the dry season the channel is continued in the bed of the river at one side for a mile or so in length, and as the river has a fall of 10 feet per mile and the channel 2 feet per mile, a channel 8 feet deep at head is secured. Generally, water is met with within 4 feet below river-bed in the dry season.

(2) Water is distributed from the channels to fields by open cuts in channel bund, the size of each, the time of closing, etc., being settled by rayats amongst themselves. As the area commanded is from 10 to 100 acres only, and the rayats are generally the same year after year, no serious disputes occur.

(3) The supply is enough for the whole year in years of ample rainfall; more from September to February; and less for the rest of the year. In years of scanty rainfall the supply is three-fourths of the above, and in years of drought half or a little more.

The supply mainly depends on the co-operation of rayats. Even in years of scanty rainfall the channels are widened and deepened and full supply secured. The rayats work the system amicably, being accustomed to it from time immemorial.

The second group of channels is those taken out from waste weir channels of tanks. Pits are excavated in one of the banks, and after plentiful supply of water is received, a channel is cut generally outside the weir channel from the bottom of the pit, till water comes to the surface. It is then distributed to the fields. These channels irrigate from 10 to 50 acres and sometimes even 100. The heads of such channels are often rivetted with stones so that the annual clearing may be minimised. The supply lasts throughout the year, but it is deficient from February to August. In years of scanty rainfall the discharge is threefourth, but rayats manage to irrigate all the lands. In years of drought half the lands are irrigated.

The third group of these channels is the channels cut in the beds of some of the tanks.

One of the sluices of such tanks is kept 5 to 20 feet below bed of tank. After the water in tank dries, a channel is cut by rayats in bed of tanks to drain the water held in suspension in the silt. The sluice thus gets water for three or four months and some of the crop under the tank is matured by the assistance of this water. Even in years of scanty rainfall 30 to 40 acres are irrigated under a tank in this way, and in years of drought half this area is irrigated; but the great advantage is that this stream forms the main supply of water to cattle and people at this time. Water is plentiful for two or three months after the channel is cut, but it does not die out altogether at any time. This source of supply is not available in other taluks where the silt is cloggy and not sandy.

13. & 14. These are questions for Revenue Officers to answer.

15. This irrigation is not supplemented by well irrigation.

16. 17. & 18. These are questions for Revenue Officers to answer.

19. There is no water-logging or salt efflorescence in the country. Wet lands are naturally well drained. For gardens, draining is done by cutting deep channels up to the low ground on the weir channel.

20. These works are maintained by the rayats themselves at great cost. As these channels give water at all times, and as the same rayats generally hold the same lands year after year, no disputes arise. The landholders under each channel generally select a headman permanently from amongst themselves, and he collects the people and gets the work done every year; and if any one does not work, he is not given water that year. The system works fairly well, and no legislation is required.

21. All the channels are practically done by rayats themselves. The assessment is for making use of water underground. Any rayat not assisting is not given water, as stated in reply to paragraph 20.

22. New channels generally affect the supply of existing channels or wells, as all these derive the water from what is absorbed by ground in the rainy season.

If a new channel is asked by any rayats, there is always a counter-petition to say that the source of some other channel or well will be diminished. On account of these presumptive rights no new channels are being excavated. One new channel was cut in Maddagiri Taluk and had to be abandoned, as water in some wells in a garden was affected by the cutting of this channel.

D.—Tanks.

The way in which tanks in the Tumkur District are supplied with water is by rainfall on its catchment. Some are fed by channels drawn from the Jayamangali and Kumudavati streams. These streams have very little of perennial supply, except from September to December, when they have a little. The feeder channels are 6 to 8 feet wide running 2 feet deep and cut from bed-level of river. There are no anicuts built across the river, but sandy banks 2 feet high are put in after each flood. In one case there is a dry stone anicut.

(2) Main channels are cut from the sluices in tank bunds. Cuts are made in the bunds of these channels and water led to fields. Two or three stones loosely put at the cut regulate the supply. Almost every field near the main channel has its cut. Fields below those near the channel bund get their supply from the upper lands.

The Mysore lands are all sloping. For paddy they are made into terraces or small level plots with ridges only 6 inches high. Water received in each field is allowed to stand in it to a depth of half a foot and the rest allowed to flow on to the next field through cuts in the ridges above mentioned. The paddy fields cannot thus remain without water for more than four or five days at most.

If the paddy fields were pits 1½ feet deep as in Guzarat, water can be kept to this depth in the fields, and they would not dry even if supply is stopped, on account of accidents, for a month.

The pits would cost a great deal and therefore they are not made. The waste of water is great in the present system.

In tank channels restored by Public Works Department the cuts above mentioned are replaced by clay pipes or masonry sluices generally 6 per mile. The maintenance of channels and distribution of water generally rest with the rayats. They therefore, after a few years, make more cuts in channel bunds, and water does not go to the end of channels. The result is

that the channels get less and less in length and water is dropped into waste weir channel and utilized by *anneys* or temporary dams.

(3) The small tanks generally fill in May to August and a crop is raised in the rainy season. In January these tanks are generally half full, and this water is kept for domestic purposes as long as possible in the hot weather.

The bigger tanks do not fill as a rule till October, and crops are put in December in some cases, and even in February in other cases. Where the same rayats cultivate the dry and wet lands of the village, they reap the dry lands in January and begin wet cultivation in February. These tanks would generally be empty by end of May on account of water being let out for irrigation; but by that time we have some rains, and these bring in some water to the tanks, and thus the water suffices for the crop, which is generally cut in the months of July and August.

Water held in a tank suffices, as a rule, for one rice crop under the tank, and as a rule five to seven crops of rice are reaped in ten years. Arecanut gardens are raised under the tanks in only such places where water can be had from wells when tanks dry. In years of ample rainfall there is water in the tanks throughout the year. The tanks are full from August to December and half full at other times. In years of scanty rainfall small tanks are full or half full from August to December, and dry for the rest of the year.

The big tanks are three-fourths full from October to December, and one-fourth to empty at other times.

In years of drought all tanks are one-fourth to one-eighth full from August to December, and dry for the rest of the period. By small tanks I mean tanks holding less than 40 million cubic feet.

(4) The area ordinarily irrigated from a tank varies from a few acres to two thousand acres. Mr. Karve, Superintending Engineer on Special Famine Duty, has prepared tables showing the number of tanks of different size in each taluk of the Province.

24. This is a question for Revenue Officers to answer.

Generally, rice is raised under tanks and arecanut gardens where wells are possible under tanks. The arecanut gardens take water from wells when tanks dry. They cannot remain long without water and can only be raised under tanks where tank water can be supplemented by well irrigation. In years of ample rainfall one rice crop is raised throughout, and an additional rice or dry crop in very few cases. In years of scanty rainfall crop is raised under such tanks as fill and not under other tanks. When tanks are half full the water is allowed to evaporate and go to waste. If there are gardens under the tank, they use the water as long as it lasts. In years of scanty rainfall, when tanks are half or three-fourths full, it is a case of lottery. Sometimes some people venture to put in a crop, and if some subsequent rain comes in to their help in time, a crop is secured. On the other hand, very often it happens that, just when the crop is maturing, the tank dries and no rain comes, and the nearly mature crop is lost. In a year of drought there is no rice crop under any tank to talk of. Gardens under tanks are maintained with difficulty by the use of well water, and these too die away, and the landholders ruined.

25. This is replied to under 24.

The rayats do not begin Kurteek (Khrif) rice crop unless the tanks are half full at least before August. Then there is sure to be some rains in October and a crop is secured.

If the tanks do not fill before September, the Kurteek crop is not attempted.

Similarly, the Rabi or Vaisak rice crop is not attempted unless the tanks are full or nearly so by December. This crop expects some help from rains in the month of May, and if these rains fail, crops under some of the tanks die.

Rayats value this Vaisak crop a great deal, because they have nothing to do in the dry season, and the value of the whole of the crop is an addition to the wealth of the country.

This crop does not get much help from rain water, and therefore consumes more water.

26. The irrigation under tanks is supplemented by well water in the Pavagada, and parts of Maddagiri and Sira Taluks.

This is very useful in years of scanty rainfall. In these years only such lands under tanks can be irrigated as can get well water after the tank dries. If there are wells under tanks and they hold water for four months at least after the tank dries, we can have double crops in three years out of ten, and single crop in five years, and only in two years half the land under each well will have to remain unirrigated.

The question is, whether there will be water in wells under tanks in other talnks when tanks dry, and whether the rayats will take the trouble of drawing water. I think if big wells or pits (10 × 10 × 6 yards) are excavated, water will suffice for maturing crops nearly ripe. This has to be investigated.

27. 28. & 29. These are for Revenue Officers to answer.

30. The Government repairs the major tanks, *i.e.*, tanks yielding more than Rs. 300, *i.e.*, tanks holding more than 80 units or 22 million cubic feet. The rayats have to do the annua maintenance of earthwork, and turf of tank bunds. The Government do the repairs required to masonry and stone-work. In the case of minor tanks, if the rayats come forward to do the earthwork gratis, Government do the masonry and stone-work. The annual maintenance is then being done as in major tanks. It is the intention of Government to do the earthwork of minor tanks also at Government cost after the major tanks are first restored. In the meantime, if the rayats want the repairs to be done soon, they must do the earthwork themselves.

My idea is that rayats are never willing to do the earthwork themselves, and this work is done only when the Taluk Revenue Officer takes special interest in the work. If the rayats do some of the earthwork, a large amount of costly revetment work has to be done by Government. My idea is that the rayats need not be expected to do earthwork, as stated in my reply to question No. 30. They must be encouraged to cultivate tank beds whenever feasible, and the revenue so derived should be specially set apart for doing earthwork to the tank.

When doing the earthwork, good, big and deep pits (10 × 10 × 5 yards) should be excavated, especially in centre of bund, so that they may hold water for cattle in the dry season when beds are cultivated. I do not think Government need spend much money on revetment. They are not required for such small tanks in a majority of cases. Government allotments will then suffice for sluices and weirs. As for annual maintenance, I do not think any change is required in the present system.

For watching and distribution of water hereditary nirganties are provided and they are paid for in grain by rayats For maintenance of channels under tanks, please see my reply to question No. 9.

31. There are very few tanks constructed entirely by private agency. Breached tanks were once restored by them. The Revenue Officers can reply to this question fully.

32. There are very few sites for new tanks. In any case where a new tank is possible, I would construct it by Government.

33. The tanks are slowly silting up. The upper tanks silt up more than the lower. The upper tanks are generally the minor tanks. Anyhow, all the tanks in the Province are silting up slowly and the bunds are wearing away The remedy applied is to raise the bunds and waste weirs every few years (once in 20 or 40 years) to make up for the capacity silted up. This is not done for minor tanks. Their capacity is thus getting very greatly diminished as they silt the most and their capacity is not being increased. The capacity of many of the major tanks in the Tumkur District was increased. This was not possible in the case of some of the major tanks, as by doing so valuable properties will be submerged. Whenever weirs are raised, it is necessary to dismantle and rebuild the revetment, and do the earthwork on bed side to prevent percolation and slips of bund. The cost is thus heavy and is undertaken only where it pays.

Silt cannot be removed by dredging or otherwise, as it will be too costly to do so. The only way to fight with it, is to raise the weirs when possible, to abandon tanks much silted up, and give out the bed for cultivation, and to build new tanks higher up instead, or raise weirs of lower ones.

To fight with this great enemy to tanks, viz., "silt" *a vigorous and continuous* policy of increasing capacity of tanks and construction of new small tanks to replace the old ones silted up is essential. It is necessary and essential to bear in mind that Government should store all the rains that falls in this dry district in years of ordinary rainfall. I consider that the whole value of crop raised in the dry season (January to June) is an increase to the wealth of the country. The raytas have nothing to do at this time, and they are able to usefully employ their time. There is such an amount of dry land in the country that its cultivation is only limited by the amount of population; and if any area is taken up for beds of tanks or for paddy under it, an equal area of waste land is taken up for dry cultivation in time.

Even half of the irrigation done in the rainy season is without prejudice to the dry crop, as the different operations for both the crops are at different times.

Any industry to which people can apply themselves in the dry season, thus utilizing their spare moments, would naturally help the country in withstanding famine. At present people go to coffee gardens, wet crops, or go out hiring their carts. Any addition to this kind of employment in the dry season will naturally help the country.

If Government have certain small manufactories or industries instituted at Government cost employing the rayats only in the dry season, and stopping them when rayats are engaged in cultivation in the rainy season, this will be a great help.

E.—Wells.

Wells exist in the Pavagada and parts of Sira and Maddagiri Taluks.

(1 and 2) Their average depth is 15 to 30 feet. Their supply is generally from percolation. It is thus essential to store as much water in tanks as possible, as wells greatly depend on tanks. In the Maddagiri and Pavagada Taluks the

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sandy nature of the upper 6 feet or so of ground does the duty of tanks by absorbing the rain water and giving it to the wells when required. The water is not generally saline. In a year of drought half the usual supply is got.

(3) Rs. 500 is the average cost of construction.

(4) If looked after now and then, the dry stone revetment lasts for 50 years. If the supply of water is good, the well is not allowed to go in disrepair.

(5) The water is usually raised by a single-*mot* or *kapile*. If double-*mot* is utilized, and the weight of an empty descending *mot* counterbalances part of the weight of the loaded *mot*, it will be a great advantage.

(6) and (7) The average area attached to a well is 8 acres, and two *kapiles* are put to it, and the whole of it is irrigated in years of good rainfall, and half of it in years of drought.

35. 36 and 37. These are questions for Revenue Officers.

38. The soil in this district is rocky. Ordinary boring tools are thus useless. Strong tools that will pierce through rock are required. The system adopted is to make a well 6' × 6' till water is met with. This can be done for 30 to 50 rupees. The rayat does this, and if he can show water, advance is given to him to widen it and to revet it where the sides are likely to fall in.

I do not think any change is necessary in this system. There are no serious difficulties in the actual construction of wells. The rayats know it from time *immemorial* and can do it the cheapest.

39. I would not build wells in land which is private property by Government agency. The present system is practically the same, but with this difference, that the work is done cheaply by the rayat interested. Money is given to the man as the work progresses, and I think the system works well.

40 When the wells are not revetted to protect the sides, they are called temporary. The rayats generally revet them when they can afford money. I think the question applies to a country like Guzarat, where water is to be had in subsoil at all places, and the number of wells is limited simply by the amount of money available to construct the works and to lift the water.

In the Tumkur District however there is no subsoil water, and especially so in years of scanty rainfall. Temporary wells are therefore of no use in years of scanty rainfall.

In the memorandum given above I have not mentioned anything I do not personally know. The information given below about crops, etc., is now collected by me from inquiry of rayats and is sent for what it may be worth. It is sent separately so that it may or may not be put before the Commission.

The information is submitted in the form of 12 estimates, taking a typical cultivating family for the standard.

The typical family is assumed to consist of two adult males, two adult females and four children, and to own four bullocks, one cow, one buffalo and one cart.

The income and expenditure of such a family is calculated—

i. for an year of ample rainfall ;
ii. for an year of scanty rainfall ;
iii. for an year of drought according as they depend—

(*a*) solely on dry lands ;
(*b*) partly on dry land and partly on land irrigated by a well ;
(*c*) partly on dry land and partly on land commanded by a tank supplying water only in the rainy season ;
(*d*) partly on dry land and partly on land below a tank which supplies water for irrigation in the spring season only.

There are thus 12 estimates for the 12 conditions.

In an year of ample rainfall the head of this family can cultivate 30 acres of dry land if he has no wet land. If he has a well he will cultivate only 20 acres of dry and will irrigate 2 acres under the well in the rainy season and cultivate the same 2 acres over again in the dry season.

If he has some wet lands under a tank under which Kartook or rainy-weather rice crop is raised, he will cultivate 10 acres of dry and 5 acres of wet. If however the wet land under the tank is irrigated, Vaisak or in the dry season, he can cultivate 30 acres of dry and 5 acres of wet.

In years of scanty rainfall and in years of drought all these lands will be in holding ; but some of the lands will have less crop and some will lie fallow. On the other hand, the prices will rise.

The amount of grain mentioned in the estimates for the maintenance of the family includes the equivalent of what will be required in the shape of doll, condiments, etc. The provision for manure is that required in addition to the manure produced in his house by his cattle, etc. From these data is derived the savings or losses of the family in each of the 12 hypothetical cases. It is then assumed that there will be six years of ample rainfall out of ten, and three years of scanty rainfall, and one of drought.

On this supposition, the head of the family will in ten years save Rs. 128 if he has dry lands only, Rs. 322 if he has dry lands and a well, and Rs. 670 if he has dry lands and wet lands irrigated Kartook, and Rs. 963 if he has dry lands and wet lands under a tank cultivated Vaisak, as per abstract attached at the end of the 12 estimates.

I—In a Year of Ample Rainfall.

Estimate of the Income and Expenditure of a Typical Cultivating Family.

Depending solely on dry crop.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
			Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
	Seers.				Manure for field	Acre.	30	0 8 0	15 0 0
					Assessment	,,	30	0 8 0	15 0 0
Yield from dry land at 320 seers per acre for 30 acres.	100	9,600	2 8 0	235 0 0	Coolies' wages during harvest season.	..	..	..	10 0 0
					Iron for plough	..	..	..	5 0 0
Deduct Expenditure.	..	..	..	181 8 0	Cost of seed at 10 seers per acre.	Seers. 100	300	2 8 0	7 8 0
					Begar's mirasi at one-tenth of the produce.	,,	960	2 8 0	24 0 0
Net Savings ..	..	..	..	54 8 0	For maintenance at 250 seers per month for a family of 2 males, 2 females and 4 children.	,,	3,000	2 8 0	75 0 0
					Clothing at Rs. 5 per female, Rs. 2-8-0 per male, and Rs. 5 for 4 children.	..	..	..	20 0 0
					Average cost per year for renewing bullocks.	..	..	..	10 0 0
					Total ..	..	..	..	181 8 0

I—In a Year of Ample Rainfall—*con'd.*

Estimate of the Income and Expenditure of a Typical Cultivating Family—cont.

Depending partly upon dry lands and partly upon well irrigation

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
Rainy Season.								Rs. A. P.	Rs. A. P.
Yield from 20 acres of dry land at 320 seers per acre, ragi.	Seers. 100	6,400	Rs. A. P. 2 8 0	Rs. A. P. 160 0 0	Assessment on dry land ..	Acres.	20	0 8 0	10 0 0
					Manure, exclusive of that got from his own cattle for dry land.	,,	20	0 8 0	10 0 0
Yield from 2 acres of thadi crop, ragi.	,,	2,000	2 8 0	50 0 0	Begar's mirasi one-tenth of produce, ragi.	Seers. 100	840	2 8 0	21 0 0
					Seeds, ragi ..	100	220	2 8 0	6 8 0
Summer or Spring Season.									
					Assessment on wet land ..	Acres	2	5 0 0	10 0 0
					Manure, exclusive of that got from his own cattle for wet land.	,,	2	4 0 0	8 0 0
Yield from 2 acres of wet lands, paddy.	,,	2,400	3 0 0	72 0 0	Paddy	.	240	2 8 0	6 0 0
						Seers.			
Total Income ..	..	..	..	282 0 0	Seeds, paddy	100	80	3 0 0	2 4 0
Deduct Expenditure ..	..	..	..	216 12 0	Cost of mending pikota, iron (materials for plough).	..	..	.	10 0 0
					Wages of coolies for weeding out and harvesting.	..	..	..	13 0 0
Saving ..	..	..	..	65 4 0	Annual cost for maintaining the well.	.	..	.	15 0 0
					Maintenance of the family and clothing.	..	..	..	95 0 0
					Renewing bullocks, annual cost.	..	..	..	10 0 0
					Total ..	..	..	..	216 12 0

Depending upon dry lands and lands commanded by tanks and irrigated in rainy season.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Yield from dry lands of 10 acres, ragi.	100	3,200	2 8 0	80 0 0	Assessment on 10 acres dry land.	Acres.	10	0 8 0	5 0 0
					Manure for 10 acres, dry ..	,,	10	0 8 0	5 0 0
5 acres of wet lands if water is given in the rainy season, paddy.	100	7,500	3 0 0	225 0 0	Mirasi to Begari, one-tenth of ragi.	,,	320	2 8 0	8 0 0
						Seers.			
					Seeds, ragi, for 10 acres ..	100	100	2 8 0	2 8 0
Total ..	..	..	..	305 0 0	Assessment on wet land ..	Acres.	5	5 0 0	25 0 0
					Manure for wet lands ..	,,	5	4 0 0	20 0 0
Deduct Expenditure ..	..	..	..	197 0 0		Seers.			
					Mirasi to nirganti at 20 seers per acre, paddy.	100	100	3 0 0	3 0 0
					Seeds, paddy for 5 acres ..	100	200	3 0 0	6 0 0
Savings ..	..	..	..	108 0 0	Wages of coolies for weeding out and harvesting.	..	..	..	10 0 0
					Iron (materials for plough)..	.	..	..	5 0 0
					Maintenance of tank bund ..	Acres.	5	0 8 0	2 8 0
					Cost of maintenance and clothing.	..	..	..	95 0 0
					Cost of renewing bullocks ..	..	..	..	10 0 0
					Total ..	..	..	..	197 0 0

Depending partly on dry land and partly on lands commanded by tanks and irrigated in dry season.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P	Rs. A. P.
Yield from 30 acres of dry land, ragi.	100	9,600	2 8 0	235 0 0	Expenditure as per estimate No. 1.	..	..	..	181 8 0
					Assessment on 5 acres wet land.	Acres.	5	5 0 0	25 0 0
Yield from 5 acres of wet lands, paddy.	100	6,000	3 0 0	180 0 0	Manure for wet land ..	,,	5	4 0 0	20 0 0
					Coolies for weeding out and harvesting.	..	..	..	5 0 0
Total ..	..	..	..	415 0 0		Seers.			
					Seeds for 5 acres	100	200	3 0 0	6 0 0
Deduct Expenditure ..	..	..	..	243 0 0	Nirganti's mirasi	100	100	3 0 0	3 0 0
					Cost of maintenance of tank bund.	Acres.	5	0 8 0	2 8 0
Savings ..	..	..	..	172 0 0	Total ..	..	..	..	243 0 0

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II—In a Year of Scanty Rainfall.

Estimate of the Income and Expenditure of a Typical Cultivating Family.

Depending solely on dry land.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Yield from 30 acres of dry land, ragi.	100	4,800	3 0 0	144 0 0	Assessment	Acres.	30	0 8 0	15 0 0
					Manure for field	,,	30	0 8 0	15 0 0
Wages that can be earned when there is leisure in spring.	..	..	..	20 0 0	Coolies during harvest and weeding seasons.	..	..	..	10 0 0
					Iron for plough	..	..	..	5 0 0
						Seers.			
					Seeds	100	300	3 0 0	9 0 0
Total .	..	..	..	164 0 0	Begar's mirasi	,,	489	3 0 0	14 6 0
					Cost of maintenance ..	,,	3,000	3 0 0	90 0 0
Expenditure .	.	..	..	183 6 0	Clothing	..	..	..	15 0 0
					Cost of renewing bulls ..	..	..	..	10 0 0
Loss ..	..	.	..	19 6 0	Total ..	..	..	..	183 6 0

Depending partly on dry land and partly on wet land irrigated by wells.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Yield from 20 acres of dry land	100	3,200	3 0 0	96 0 0	Assessment on dry land ..	Acres.	20	0 8 0	10 0 0
					Manure for dry land ..	,,	20	0 8 0	10 0 0
						Seers.			
Yield from Thodi crop in 2 acres	..	2,000	3 0 0	60 0 0	Seeds, ragi	100	220	3 0 0	6 8 0
					Assessment on wet land ..	Acres.	2	5 0 0	10 0 0
					Manure for wet land ..	,,	2	1 0 0	2 0 0
Yield from wet crop in spring, paddy from 2 acres.	..	2,000	3 8 0	70 0 0		,,	1	4 0 0	4 0 0
						Seers			
					Seeds, paddy	100	40	3 8 0	1 6 0
					Cost of mending pikota and iron for plough.	..	..	..	10 0 0
						Seers.			
					Begar's mirasi, ragi	100	520	3 0 0	15 8 0
Total .		..	.	226 0 0	Do. paddy ..	,,	100	3 8 0	3 8 0
					Coolies for weeding out and harvesting.	..	..	..	10 0 0
					Annual cost of maintaining the well.	..	..	..	15 0 0
Expenditure .	.	.	..	212 14 0	Maintenance of family and clothing.	..	..	..	105 0 0
					Cost of renewing bulls ..	..	..	..	10 0 0
Savings ..	..	..	..	13 2 0	Total ..	..	..	..	212 14 0

Depending partly on dry land and partly on lands commanded by tanks supplying water in the rainy season.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Yield from 10 acres of dry land, ragi.	100	1,600	3 0 0	48 0 0	Assessment on 10 acres dry land.	Acres.	10	0 8 0	5 0 0
					Manure for ditto	,,	10	0 8 0	5 0 0
Yield from 5 acres of wet land, paddy.	100	6,000	3 8 0	210 0 0	Assessment on wet land ..	,,	5	5 0 0	25 0 0
					Manure for ditto	,,	5	4 0 0	20 0 0
					Mirasi to nirganti, paddy ..	Seers.	100	3 8 0	3 8 0
					Mirasi to Begari, ragi ..	,,	160	3 0 0	4 12 0
					Coolies for weeding out and harvesting.	..	..	..	10 0 0
					Seeds, paddy	Seers.	200	3 8 0	7 0 0
Total ..	..	..	..	258 0 0	Seeds, ragi	,,	100	3 0 0	3 0 0
					Maintenance of tank bund ..	Acres.	5	0 8 0	2 8 0
Expenditure ..	..	..	..	200 12 0	Cost of maintenance and clothing.	..	..	..	105 0 0
					Cost of renewing bulls ..	..	..	..	10 0 0
Savings ..	..	..	..	57 4 0	Total ..	..	..	..	200 12 0

II—In a Year of Scanty Rainfall—*cont.*

Estimate of the Income and Expenditure of a Typical Cultivating Family—cont.

Depending partly on dry lands and partly on lands below tanks

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Yield from 30 acres of dry land, ragi.	100	4,800	3 0 0	144 0 0	As per estimate No. 5 ..	..	..	..	183 6 0
Yield from 5 acres wet land.	,,	3,700	3 8 0	129 8 0	Assessment on 5 acres of wet land.	Acres.	5	5 0 0	25 0 0
					Manure for ditto .. .	,,	5	4 0 0	20 0 0
					Coolies for weeding out and harvesting.	..	..	..	5 0 0
Total ..	..	..	.	273 8 0	Seeds	Seers.	200	3 8 0	7 0 0
					Nirganti's mirasi	,,	100	3 8 0	3 8 0
Expenditure ..	.	..	..	246 6 0	Cost of maintenance of tank bund.	Acres.	5	0 8 0	2 8 0
Savings .	..	..	..	27 2 0	Total ..	..	..	..	246 6 0

III—In a Year of Drought.

Estimate of the Income and Expenditure of a Typical Cultivating Family.

Depending solely on dry land in a season of drought.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
			Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Income from dry land.	..	..	..	..					
					Assessment on 30 acres ..	Acre	30	0 8 0	15 0 0
Income from working as coolies and hiring carts, average per month that could be earned by the family.	Month	7	10 0 0	70 0 0	Cost of maintenance ..	Seers. 100	3,000	6 0 0	180 0 0
					Clothing	..	..	..	..
Total Income ..	..	..	..	70 0 0					
Total Expenditure ..	..	..	..	205 0 0	Cost of renewing bullocks ..	..	..	..	10 0 0
Loss ..	..	..	..	—135 0 0	Total ..	..	..	..	205 0 0

Partly depending upon dry lands and partly upon well irrigation in a season of drought.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
	Seers.		Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Rainy season, Thadi crop in two acres yield.	100	1,400	6 0 0	84 0 0	Assessment on dry land .	Acre.	10	0 8 0	5 0 0
					Assessment on wet land ..	,,	2	5 0 0	10 0 0
In Spring, jola or navane that can be got from 2 acres.	,,	800	6 0 0	48 0 0	Begar's mirasi	Seers. 100	220	6 0 0	13 3 0
					Seeds	100	40	6 0 0	2 6 0
Wages and cart-hire that could be earned by the family in two months when it will have leisure.	Months.	2	10 0 0	20 0 0	Cost of mending pikota and plough.	..	..	..	5 0 0
					Annual cost of maintaining the well.	..	..	..	15 0 0
					Maintenance of the family ..	Seers. 100	3,000	6 0 0	180 0 0
Total ..	..	..	..	152 0 0					
Total Expenditure ..	..	..	..	240 9 0	Cost of renewing bullocks ..	..	..	..	10 0 0
Loss ..	..	..	..	—88 9 0	Total ..	..	..	..	240 9 0

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III—In a Year of Drought—*cont.*

Estimate of the Income and Expenditure of a Typical Cultivating Family—cont.

Partly depending upon dry lands and partly upon land below tank in a season of drought.

Sources of Income.	Per	Quantity.	Rate.	Cost.	Sources of Expenditure.	Per	Quantity.	Rate.	Cost.
			Rs. A. P.	Rs. A. P.				Rs. A. P.	Rs. A. P.
Wages and cart-hire that could be earned by the family in seven months during which it will have leisure.	Month	7	10 0 0	70 0 0	Assessment on 10 acres of dry lands.	Acres.	10	0 8 0	5 0 0
					Assessment on 5 acres of wet land.	,,	5	5 0 0	25 0 0
					Cost of renewing bulls ..	..	..	..	10 0 0
Total Expenditure	..	..	..	220 0 0	Cost of maintenance ..	..	..	..	180 0 0
Loss	..	..	..	-150 0 0	Total ..	..	..	..	220 0 0

Abstract.

	In an year of ample rainfall.			In an year of scanty rainfall.			In an year of drought.			Total.	Remarks.
	Number of years	Savings per year.	Total Savings.	Number of years.	Savings per year.	Total savings.	Number of years.	Savings per year.	Total savings.		
1	2	3	4	5	6	7	8	9	10	11	12
		Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.	Rs. A. P.	
(*a*) When the family depends solely on dry lands.	6	53 8 0	321 0 0	3	-19 6 0	58 2 0	1	—135 0 0	-135 0 0	127 14 0	
(*b*) When the family depends partly on dry lands and partly on lands irrigated by well.	6	65 4 0	371 8 0	3	13 2 0	39 6 0	1	—58 9 0	-58 9 0	322 5 0	
(*c*) When the family depends partly on dry lands and partly on lands below tanks which supply water in the rainy season.	6	108 0 0	648 0 0	3	57 4 0	171 12 0	1	—150 0 0	-150 0 0	669 12 0	
(*d*) When the family depends partly on dry lands and partly on lands below tanks which supply water in the dry season	6	172 0 0	1,032 0 0	3	27 2 0	81 6 0	1	—150 0 0	-150 0 0	963 6 0	

Oral Evidence.

1. Q (*The President*).—You are Superintending Engineer in charge of the Mari Kanave reservoir, I understand?—Yes.

2. Q. That is your special work?—Yes.

3. Q. Is it entirely confined to that?—Yes.

4. Q. What were you before?—I was Executive Engineer, Tumkoor, for 17 years.

5. Q. You were Superintendent of channels?—Yes, for five years.

6. Q. That is not under the Public Works Department?—Yes, it is under the Public Works Department.

7. Q. You say in your answer to question No. 3 "when I proposed to utilize water in some tanks in Sira taluk for irrigation of dry crops the ryots said that for this kind of crop a lot of manure was required." Do they ever put dry crops under tanks?—Sometimes when there is little water; my idea was that they should irrigate 5 acres instead of one.

8. Q. (*Mr. Ibbetson*).—Don't they manure rice heavily?—They put in 'hongo' leaves as manure.

9. Q. They don't use so much manure as for dry crops?—No.

10. Q. (*Muir-Mackenzie*).—They don't use much cattle manure?—No.

11. Q. (*The President*).—I see you give a list at the end showing the cost of manure. You say in reply to question No. 5 "if a tank fills half there will not be water enough for all, and as all wish to irrigate their lands the water is allowed to evaporate and go to waste and all the lands lie fallow." Cannot they arrange matters among themselves?—No; they require some one to show them the way.

12. Q. Don't they draw lots?—Some rules are required on the point badly.

13. Q. The punchayat is not in force?—No; there are no rules to guide the Revenue officers.

14. Q. (*Mr. Ibbetson*).—Does that often happen?—Yes.

15. Q. (*The President*).—What is the remedy for that?—If they can irrigate only half the area water should only be allowed for that; those that are at the head of the channel must be given it, others must go without it and be given a remission of assessment.

16. Q. Has that been laid before the Government?—No: the Revenue Department manage the distribution of water.

17. Q. So that the water is wasted, and at a time of drought when it is most necessary to use it?—Yes; I don't think the Revenue officers are certain what their powers are.

18. Q. You know the Tumkoor district best?—Yes.

19. Q. The Deputy Commissioner of Tumkoor has mentioned six projects there, "(1) Shimsha project, (2) Right bank channel of Bommakanave dam, (3) Javagondanahalli project, (4) Honnamachanalli new tank, (5) Heggadahalli tank, and (6) Tumbadi tank." The Shimsha would be a big business, 10,000 units?—It will be costly, but in time it will pay; a masonry dam is required.

20. Q. Of what height?—About 80 feet.

21. Q. The Deputy Commissioner says of this project "cost about Rs. 18 lakhs and area to be brought under irrigation is about 25,000 acres."?—Yes, I selected the site.

22. Q. What is the size of the catchment basin?—2,000 square miles, but there are a number of tanks in it.

23. Q. As regards the Boranakanave dam?—It is 65 feet above the river bed, it is capable of irrigating 5,000 acres on left bank; channels for 1,000 acres have been cut.

24. Q. You have got channels for 1,000 acres?—Yes, I submitted designs and estimates for the remainder, but a decision has not yet been arrived at.

25. Q. I suppose it is certain to be sanctioned?—There are one or two alternatives.

26. Q. Until this is done you cannot take full advantage of the tank?—No; a dam may be put 15 miles below to utilize water from the reservoir.

27. Q. Then there is Honnamachanahalli new tank?—That is a small tank with a catchment of 20 square miles; it will pay 3 to 4 per cent.

28. Q. And the Heggadahalli tank?—That is in Chittaldroog, in place of the Heggadahalli is the Mari Kanave.

29. Q. Lastly, the Tumbadi tank?—That cannot pay more than 2 per cent. It has 15 square miles of catchment.

30 Q. Is there much well irrigation in Tumkoor?—Only in 3 taluks.

31. Q. Why is there not much in the other taluks?—Because the soil is deep clay and does not contain much water.

32. Q. Is it black soil?—It is ordinary red earth: in these three taluks it is sandy soil with granite below, the water soaks into the earth and the granite does not allow it go lower.

33. Q. You have no wells there?—We have wells only in these 3 taluks, Sira, Mudagiri and Powghad.

34. Q. I remember Tumkoor suffered very much in time of famine: did it suffer from want of drinking water?—Parts of Tumkoor did.

35. Q. You say in reply to question No. 9: "I would maintain by Government agency channels and *aneys* of all tanks yielding more than Rs. 4,000 annually and terminal tanks even if they yield Rs. 1,000. A cess to be recovered from the lands to be benefited and kept at the credit of that work. A permanent committee of three men selected every five years by rayats to do the work by *amani*, without waiting for sanction, as long as there is money at the credit of the work." Do you mean these three men were to do all the work?—Yes, otherwise the rayats won't join every year; these three men should be managers.

36. Q. Would you entrust the cess to these men?—The money would be kept with Government and they will keep a nominal roll of coolies, who would be paid on the rolls being presented.

37. Q. Have you made that proposal to Government?—I have not made it.

38. Q. You say in reply to questions under "general"—"We ought to store the flood waters by constructing reservoirs and feeding them with flood waters." Where would you store flood water?—I would take water from the Alulgatta anicut about 20 miles above Mysore across the Cauvery and store it in the neighbouring valleys.

39. Q. You say in your remarks under the head C "even in years of scanty rainfall the channels are widened and deepened and full supply secured." That is for channels of intermittent flow?—These are small channels. There are only a few rayats on the channels and they work amicably.

40. Q. You say channels are cut in the beds of some of the tanks?—Yes, there is one 20 feet below the general bed of the tank.

41. Q. You say in paragraph 20 "these works are maintained by the rayats at great cost?"—Yes, at a cost of labour, not of money.

42. Q. You say they do it amicably?—Yes.

43. Q. You say in the same paragraph "the landholders under each channel generally select a headman permanently from amongst themselves and he collects the people and gets the work done every year; and if any one does not work he is not given water that year." Cannot they do the same thing in tanks?—They don't generally do it; those that are near can get water without combining.

44. Q. You say in your remarks under the head of tanks—"if the paddy fields were pits 1½ feet deep as in Guzerat, water can be kept to this depth in the fields and they would not dry even if supply is stopped, on account of accidents, for a month." That is not the custom here?—No.

45. Q. You say in paragraph 30 "it is the intention of Government to do the earth-work of minor tanks also at Government cost after the major tanks are first restored." When is that going to be done; won't it take a long time?—Yes, it is necessary that minor tanks should also be done, that was the reply given to the representative members by the Diwan.

46. Q. Have you ever made any experiments to ascertain at what rate these tanks silt up?—No, I have not.

47. Q. You say that the average cost of construction of a well is Rs. 500. Do you mean a *pukka* well?—One revetted with stones but not with mortar, they don't use mortar here.

48. Q. (*Mr. Higham*).—You think rayats should not be called upon to execute any repairs to tanks?—Once Government brings the tanks up to the standard, the rayats must maintain the earth-work at that standard.

49. Q. You think it better that they should not be called upon to do it?—That is for minor tanks—tanks yielding less than Rs. 500 a year; I think the present rule is hard, they pay the assessment all the same whether there is water or not.

50. Q. If Government puts the tank into repair do you think the rayats should maintain it afterwards?—Yes.

51. Q. How would they maintain it?—The bund is divided into different portions, in proportion to the holdings of the rayats; if a rayat does not do his portion the Government does it and the cost is recovered like revenue, that is the rule, a law is required on the point.

52. Q. Is anybody in the village made responsible?—The *patel*; if any person fails to do his share the matter is reported by the patel and orders are issued by the amildar.

53. Q. Have they over a committee or panchayat?—No.

54. Q. What is the amount of the irrigation cess?—It is 8 annas an acre; that is now merged into the assessment.

55. Q. How long ago was that?—Since the Revenue assessment about twenty years ago.

56. Q. There is no such thing as an irrigation cess now?—No.

57. Q. Does each work have a separate account?—It is for the whole of the district.

58. Q. In your note you propose that each tank should have a separate account?—That is in addition to this cess.

59. Q. You propose to have a new cess?—Yes, that is for works they are supposed to do.

60. Q. Would it not be better to make them do it rather than trouble them with a new cess?—They don't do it as a matter of fact.

61. Q. You say that, when a tank only fills half, people don't take water from it. Are there many tanks like that?—Almost every tank in the province; they take some water for garden land.

62. Q. They do that simply because they cannot make out who is to take it?—Yes.

63. Q. I suppose in bad years all the tanks don't fill half?—No.

64. Q. Do you mean to say that then the water is not used?—No.

65 Q. What year are you thinking of?—Even this year there are some tanks that are only half full and the water will not be utilized.

66. Q. Does it remain in the tank?—It will evaporate.

67. Q. Then nothing will be left?—Very little.

68. Q. Is there any way of getting over that difficulty?—A smaller quantity only should be allowed, sufficient for one crop; that must be near the bund itself; they should have a preferential right to it; those lower down must be given some remission of assessment.

69. Q. Why should those lower down not get it?—We should have to give it by turns, another year those lower down should get it.

70. Q. Why don't the people who are high up take it now—Because everybody wants it; there is a great deal of waste.

71. Q. Why cannot each take enough for half the area?—It is difficult to arrange between themselves.

72. Q. And so none of them take the water at all?—No.

73. Q. There are a great many wells?—Only in three taluks—Mudagiri, Powghad and Sira.

74. Q. Do they irrigate their lands from the wells or tanks direct?—From the tank if they can get it, but when that dries up from the well.

75. Q. (*Mr. Ibbetson*).—On these channels that you speak of that the people keep in good repair, are there any absentee owners?—If there are absentee landholders who don't give labour, they won't be given water.

76. Q. Who supplies the labour?—The tenants.

77. Q. When there is an absentee holder?—He won't be given water.

78. Q. Does he or the tenant supply the labour?—If the tenant gives it he will recover it from the rent.

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79. Q. You suggest that the beds of these small tanks should be cultivated; do you think that would make the tanks silt up much faster?—No.

80. Q. Have you any experience to go upon; have you seen the beds of the tanks cultivated?—Yes.

81. Q. You don't think it does any harm, as far as silting goes?—No, it is only shifting the silt from a higher to a lower level.

82. Q. (*Mr. Muir-Mackenzie*).—Was there any year in which all the tanks failed to fill even half?—In 1892 I believe.

83 Q. None of the tanks filled half?—Some did, very few.

84. Q. The great majority failed to fill half?—Yes.

85. Q. Did the people not utilize the water at all?—No.

86. Q. (*Mr. Rajaratna Mdlr*).—When supplies in the tanks are low or the tanks are only half full, don't the Revenue Officers or Revenue Inspectors go to the spot and arrange for a certain area being cultivated. Why was that not done?—They think they have no authority under the present law to interfere with the cultivators.

87. Q. They have the power to regulate the distribution of water?—Yes

88. Q. Why cannot the water be distributed?—It may be done.

89. Q. May it be due to the fact that they think they will get the revenue anyhow?—Certain Revenue Officers are afraid they have no authority.

90. Q. Here, owing to the system of not granting remissions, the revenue does not suffer: has that anything to do with the indifference of officials?—They are afraid if they interfere they will be put into Civil Courts.

(*Mr. Ibbetson*).—Mr Clerk says the same thing happens in Bellary.

With the permission of the President the witness read the accompanying paper on irrigation in Guzarat:

MEMO.

I am a native of Guzarat (Kaira District). I know the place well as I was there for twenty years, and I visit it every three years, when I go on leave. I hold lands there.

Mr. Himatlal, retired Executive Engineer, Bombay Public Works Department, and now President, Ahmadabad Municipality, has deposed before the Commission that there is no necessity for channels in Guzarat I beg to differ from him. He was always in the roads and building department, and may not be aware of the advantages of irrigation. Small tanks as recommended by him are not quite possible in Guzarat, as land is very flat, and too costly to be spared for tank beds. The so-called tanks are merely large pits made in the ground. They are primarily for domestic purposes; but water is lifted from them for irrigation also. Irrigation from wells is very costly. The soil of parts of Ahmadabad and Kaira districts, bordering on the river Sabarmati and its tributaries is alluvial red soil quite fit for the raising of valuable dry crops, including tobacco, opium, &c.

I am strongly of opinion that irrigation by canals from the rivers in these districts will *very greatly* benefit these districts, and if cultivation of rice is restricted under the channels the place will not get unhealthy. There is very little of black-cotton soil in these districts. Black-cotton soil also requires water, and the question for determination is when it is required, and in what quantity. It is the excess of water that does harm in this case. We have to give only the required quantity, and leave the present crop on it unaltered. With a proper quantity of water, the amount of crop whatever it may be, is bound to increase by the timely giving of water especially when the rains do not come in proper time.

All these parts of Guzarat are irrigated by wells, wherever people can afford money for sinking wells, and drawing water at great cost. The rivers have not got much water in the dry season, and therefore it may be supplemented by the construction of large reservoirs at their heads. In any case the water in the rivers is enough for a crop in the rainy season.

It is stated by some that, as parts of the country suffer from inundation, there is no necessity for irrigation. This I beg to represent is an erroneous idea. There are often heavy rains in the hills from which these rivers take their rise. These bring down the floods and damage the flat land near the sea while actually the crops on the spot are withering for want of water. That irrigation is necessary and is desired by people is proved by the construction of a number of costly wells, wherever people can afford the cost and by the high value of such lands. Lands under wells cost Rs. 500 to Rs. 1,000 per acre.

Broadly speaking wherever lands are being irrigated by wells, they should be replaced by river channels where possible as by doing so the area irrigated is very greatly increased and cost of irrigation reduced very much. Besides this, we shall be giving water laden with rich silt instead of well water which does not contain it. Even if the channel water is not enough in summer, it can be supplemented by well irrigation as once channels are established springs in the wells will rise. The wells are at present 30 to 40 feet deep and have to be lined with brick masonry, and are therefore necessarily very costly. But if channels raise the spring level and water is met within 10 or 15 feet, temporary wells without any lining can be cheaply excavated and used for dry weather crop.

WITNESS No. 41—Mr. V. H. KARVE, Superintending Engineer.

Mr. Karve.

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Written Evidence.

[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

Question No 1.—To the whole Province.

I was in charge of two districts for years as Executive Engineer; in three others for four years as Superintending Engineer: and in temporary charge for two months in the remaining three.

2. Average rainfall for 31 years—1870–1900.—(Report on Rainfall Registration in Mysore for 1900, Table II):—

Bangalore	30·85
Kolar	27·57
Tumkur	26·39
Mysore	27·36
Hassan	35·29
Kadur	61·03
Shimoga	63·24
Chitaldrug	22·00

3. In places only the following obstacles to extension of irrigation exist:—

(1) sparsity of population;
(2) lack of capital; and
(3) unhealthiness of locality owing to prevalence of malaria.

6. To a small extent for some time. I know when the Ramasamudram, Saligram and Ramasamy channels were extended, the value of the old lands went down from 25 to 30 per cent. It has since been gradually rising to the original value with the increase of population. The desire is strong everywhere as wet cultivation is more valuable.

B.—Canals of Continuous Flow.

7. (1) This cause does not increase the value of land, as one crop only is raised under canals in the Province. For the second crop there is not sufficient water in the source of supply.

(2) This increases the value about cent per cent where land is fit for raising more valuable crops, such as sugarcane and mulberry.

(3) (*a*) This also increases about cent per cent. Whether the rainfall is ample or scanty or no rainfall, the value of the produce of the land is not affected.

In years of drought the produce will be less, but the price will be high; and in years of ample rainfall the produce will be more and price less, so the sale-proceeds of the produce will nearly be the same in both cases. One more cause tends considerably to increase the value of lands under canal of continuous flow, *viz.*, certainty of crop.

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It will be observed from the above that the value of wet lands under canals of continuous flow is at least four times that of dry lands in the neighbourhood.

8. (1) Double the average of normal term of year compared to the value of produce per acre of dry land:

(2) and in a year of drought the value might bear a very large ratio to the produce per acre of dry land.

10. Yes, it is necessary. It costs from Rs 15 to 25 per acre to prepare land for irrigation. As far as I know, it is paid by the landlord.

C.—Canals of Intermittent Flow.

12. (1) Canals are generally made by Government, but dams of a temporary nature are thrown by ryots. The dams are built of a sufficient height to allow sufficient supply of water to flow in the canals.

(2) By means of temporary sluices built of dry stones or earthen pipes.

(3) (*a*) For about a month and a half, *i.e.*, in the latter part of June and whole of November Rains generally cease at the end of October.

(*b*) For about four months.

(*c*) For about five months.

13. As stated above, under canals of continuous flow the value increases four times. In the present case, however, the supply is somewhat uncertain, so the value may be said to increase only two times.

15. In the case of canals there are no wells to supplement the supply. Wells are a desideratum when supply fails in canals and where there are gardens under them; but unfortunately water cannot be tapped in them at a reasonable cost.

16. (1) About 1½ times.

(2) May bear a high ratio.

18. Please see answer to question No. 10.

20. As per rules at present in force, with the exception of clearing weeds, all the repairs are carried at the expense of Government. It is paid for from the Irrigation Cess Fund. Approximate annual cost of repairs per acre irrigated is eight annas. The system works well, except clearance of weeds, which has to be done by ryots, but which is done by them very perfunctorily. The result is weeds obstruct the flow of water, cause accumulation of silt, and impair the condition of canals. Legislation on this point is very desirable if Government is not disposed to bear the cost also of weed clearing.

D.—Tanks.

23. (1) Nearly all the tanks in the Province depend upon local rains and have no perennial or far-reaching source of supply. So one year of drought suffices to dry them up.

(2) Water is let out through sluices from which distribution channels are made. Distribution to land is generally made through cuts in banks which are closed and re-opened by ryots according to necessity.

(3) Please refer to answer to question No. 13 (3).

(4) I do not understand the question.

24. Answer is the same as given to question No. 13, except that in a year of scanty rainfall and in a year of drought there is no difference in value of produce from dry and wet lands as little or no crops are raised on either.

25. Yes, in the case of gardens under tanks. They are very essential when tanks dry up.

27. (1) Double, as in the case of channels of continuous flow.

(2) In a year of drought there will be no crop under most of the tanks.

29. Yes, from Rs. 10 to 15. Cost is incurred by the landlords, so far as I know.

30. No silt clearing is done from beds of tanks. It would be very costly to do so. As regards repairs to bunds, earthwork has to be done by ryots: all other work, including repairs to sluices and waste weirs, are done at the expense of Government. Repairs to distribution channels are left to ryots, except where the channels are long and irrigate large areas, in which case all masonry work are repaired by Government. The ryots do not attend properly to repairs to bunds nor to distribution channels. Earth repairs to bunds cannot be allowed to be neglected. Instead of making a law compelling ryots to do it, it would be better to raise the irrigation cess from one to two annas—Government undertaking also that item of work.

No separate maintenance is provided for each tank. The repairs are carried out by Government, except earthwork, and paid for from Irrigation Cess. The cost of maintenance of tanks, excepting distribution channels, would be approximately 4 annas per acre.

32. Yes, I do, inasmuch as judging from experience of present private tanks their owners will neglect the tanks and their breaching might affect Government tanks below.

33. Not much, as silting up is very slow. Narasambudi tank of Nanjangud Taluk has silted up 20 feet. So also the Dharmasagara tank of Hiriyur taluk, Chitaldrug district. Enquiry showed that they were constructed 200 years ago. There is one tank in the Kolar district by name Ruddikere in Chikballapur taluk which had breached in 1878 at the old sluice. I remember to have then found that the sill of the sluice was 25 feet below the bed, and as per enquiries, this tank was constructed about 300 years ago. These instances will show that tanks silt 1 foot in from 10 to 12 years.

It is not the custom to remove the silt from beds of tanks. It is much cheaper to raise the weir and bund than clearing of silt.

The usual method with the ancient builders of tanks was to throw silt-dams across water-courses feeding the tanks. These dams used to hold silt in suspension only as long as they did not breach. When they breached, all the silt used to escape into the tanks, so that practically this mode is useless Dredging would be a very costly method. Planting a thick belt of trees, and bushed round the margins of waterspreads, would be a cheap and efficacious method. Not only will this keep out silt but also supply fuel, so much in request in Maidan parts of the Province.

Oral Evidence.

1. Q. (*The President*).—You are Superintending Engineer just now on special duty?—Yes.

2. Q. What is your special duty?—Preparing projects for famine protective works.

3. Q. You have been a long time in this province?—Yes, I have been here for the last twenty-seven years.

4. Q. How long have you been preparing projects?—I began in October.

5. Q. What part of the Province are you turning your attention to?—I made a preliminary investigation of the whole Province and submitted a statement of the protective works of the whole Province.

6. Q. What is the result?—I have prepared statements of works proposed and submitted them to the Chief Engineer: I am now going on with the preparation of projects.

7. Q. Generally, do you see an opportunity of adding to the number of tanks or of reservoirs?—There is not much scope for additional works. The Shimsha is the only work of importance. There is an anicut in the Shimoga district across the Bhadra which will cost 17 lakhs.

8. Q. Is there nothing on the Hamavati side of the Cauvery?—We have anicuts all along the Cauvery; there is a fine site at Ramaswamy Kanve on the frontier, but if you construct a reservoir there you will submerge the town of Emzerpet.

9. Q. How large it would be?—It will hold 10,000 units, I'm afraid it will not be permitted.

10. Q. There is nothing in Hassan or Kadur?—No, the Boranakanave channel project is in hand.

11. Q. Is there nothing more to be done for Kolar?—It is studded with tanks; there is no scope for big tanks there.

12. Q. If another famine came, do you think the Province would be in a better position than before to stand it?—Yes, we have improved old works and constructed some new ones; so we are in a better position to stand a famine.

13. Q. The tanks would run dry again?—Yes, but in ordinary years they raise more crops than before.—I think it would be a good thing if Government could limit the irrigation under each tank according to the quantity of water it receives.

14. Q. (*Mr. Ibbetson*).—In each year?—Yes, except in years of good rainfall.

15. Q. (*The President*).—You say in answer to question No. 6 "I know when the Ramasamudram, Saligram and Ramasamy channels were extended the value of the old lands went down from 25 to 30 per cent." Was that by the population moving?—No; all the land under river channels is held by influential persons, when these channels were extended they had to reduce the rents.

16. Q. You say in answer to question No. 15 "in the case of canals there are no wells to supplement the supply." Are there not plenty of wells?—There are no wells under canals.

17. Q. Colonel Grant showed us a number of wells under canals in a map that he had?—There are no canals in Chitaldroog; there are wells along the banks of streams from which they irrigate.

18. Q. If there were canals there would be no difficulty in making wells under them?—In certain places there might be difficulty; generally canals run close to rivers, it is not in every

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place that wells could be made; there are only tanks here and there which are fed from canals.

19. Q. But under tanks there are wells?—Not as far as I remember, nor is it necessary; these tanks are fed from canals.

20. Q. In the case of tanks that are not fed by canals?—There are few of those, I am talking of tanks fed by canals.

21. Q. You say in your answer to question No. 20 "as per rules at present in force, with the exception of clearing weeds, all the repairs are carried out at the expense of Government. I understood that the rayat did the silt clearance?—On the river channels it is carried out by Government.

22. Q. That is not much?—It is left to the rayats and they don't do it well.

23. Q. What legislation would you like for that?—I think Government should do it.

24. Q. Would you increase the cess?—Yes, it will have to be done; the area irrigated from these channels is about 100,000 acres, the revenue realized is nearly Rs. 6,00,000; the irrigation cess at one anna on the rupee comes to about Rs. 40,000; whereas the cost to Government is *Rs. 66,000*; the cess is too low and should be increased to two annas on the rupee, this would enable us to do the repairs of both channels and tanks.

25. Q. Have any proposals been made to Government?—They were once made, there is some difficulty about it.

26. Q. Do you think Government could manage to do these repairs all over the country?—It would be difficult, because there are a great number of tanks; the Revenue and Public Works Departments together might do it.

27. Q. You say in the last paragraph *referring* to the keeping out of silt "planting a thick belt of trees and bushes round the margins of waterspreads would be a cheap and efficacious method." How does that stop it?—It will keep out the silt which however will have to be removed otherwise it will accumulate.

28. Q. Does it not come in a good deal by the stream that feeds the tanks?—Yes, but the proposed belt of trees and bushes will check its running into the tanks. I think it is the only way of keeping out the silt.

29. Q. How will you manage it?—I think the rayats should be compelled to do it.

30. Q. Has it been tried anywhere?—No.

31. Q. (*Mr. Ibbetson*).—I understood from Mr. Dalal's evidence that the irrigation cess had been abolished; there is no separate cess?—No.

32. Q. When you say you would raise the irrigation cess you mean Government should take twice as much from the land revenue to repair the tanks?—Yes, it would have to be recovered from the rayats.

33. Q. Have you ever known cases where a tank being half full, the people would not use the water, because they could not decide who was to have it?—Yes, it is only where a tank belongs to a single individual that it is managed better; where the water belongs to all they all use it and all suffer.

34. Q. Do they leave the water unused when the tank is half full?—No, I have never known that.

35. Q. Have you been Executive Engineer for many years?—Yes.

36. Q. (*Mr. Muir-Mackenzie*).—You say that the Marikanave project would save Chitaldroog, and that it would irrigate 30,000 acres; would it irrigate that in a dry year?—I cannot say, I don't think so.

37. Q. Would it fill in a famine year?—No.

Witness No. 42—M.R.Ry. B. G. Krishniengar, Deputy Commissioner, Tumkur District.

Written Evidence.

M.R.Ry. Krishniengar.

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[*Note.*—The numbering of the paragraphs refers to the list of printed questions for Revenue Officers.]

A.—General.

1. The answers below refer to the Tumkur District. I was the General Assistant Commissioner in charge of the several taluks of the district from 1883 to 1887, and was Special officer in 1892, and in 1893 appointed by Government to grant loans for irrigation wells. I am now in charge of the district since April last. I have also done duty as Assistant or Deputy Commissioner in six of the other seven districts of the Province (except the Mysore District).

I am a landholder and farmer paying more than Rs. 3,000 to Government for Kayamgutta, Jodi and Kandayam lands.

2. The average rainfall of the last three calendar years in the district is given below:—

Taluk.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Talukwar annual average.
Tumkur		0·80	..	0·98	3·23	2·31	4·0	2·82	10·50	6·48	1·40	0·30	32 82
Maddagiri		0·30	..	1·43	2·45	1·82	1·34	1·92	11·11	4·78	0·46	0·14	25·75
Koratagere		0·71	..	0·62	2·08	2·53	2·30	1·75	6·95	5·43	0·98	0·17	23·52
Chikmayakanhalli		0·73	..	1·31	4·08	1·36	1·47	0·53	7·10	7·51	0·52	..	24·61
Huliyar		0·22	..	1·06	3·06	1·58	0·30	0·45	4·95	6·49	0·65	0·13	18·89
Sira		0·28	..	2·07	1·81	1·42	2·16	1·10	7·08	4·23	0·27	·05	20·47
Gubbi		1·10	..	0·83	1·85	2·70	2·18	1·30	8·15	5·48	0·70	·033	24·82
Tiptur		0·28	..	1·86	3·77	0·52	0·82	1·32	7·26	4·31	1·27	0·14	21·55
Turuvekere		0·40	..	1·06	4·07	0·98	1·36	1·46	9·36	6·65	1·63	0·26	2·23
Pavagada		0·17	..	1·75	1·54	2·03	1·91	0·87	8·45	3·92	0·35	0·17	21·16
Kunigal		0·21	..	1·16	3·06	3·28	1·61	1·88	14·01	7·39	0·54	0·30	33·44
Monthly average for the district ..	..	5·20	..	14·13	31·0	20·53	19·45	16·40	94·92	62·67	8·77	1·99	274·06

(1) It is only under the Borankanave tank between Sira and Huliyar, and situated in the latter sub-taluk, that the extension of irrigation is blocked owing to the sparsity of population.

(2) and (3) No.

(4) There are some tanks in the Tumkur, Sira and Pavagada taluks, under which portions of lands are saline black soil and are allowed to remain waste, being taken up for cultivation at intervals of one or more years.

(5) In Tumkur, Gubbi, Sira and Pavagada taluks there are tracts in which the rainfall being uncertain, certain tanks do not receive sufficient supplies of water. In such cases lands are thrown up annually and retaken on the tanks receiving necessary supplies. In the Pavagada and Sira taluks specially the early rains sometimes fail and at other times there is too early cessation of rain. This is the case in the north-eastern part of the Maddagiri taluk also.

(6) Not to any appreciable extent.

(7) and (8) No.

(9) None.

4. In the case of tanks constructed on private holdings, there will be no enhancement of revenue during the period of current settlement. This temporary exemption is secured by obtaining beforehand the permission of Government to construct it. So far as I know, lands irrigated under such tanks are only cultivated on 'waram' tenure. I don't think the existing provisions are sufficiently liberal. It deters private capitalists from expending money at a later stage of settlement, since they may not have sufficient interval to recoup the cost or derive a reasonable profit. In such cases a guarantee of thirty years from the date of the construction of such work will be a just and proper encouragement.

5. *Loans are freely taken for extension of irrigation.* The terms on which loans are given are sufficiently liberal and require no alteration.

6. No.

B.—Canals of Continuous Flow.

7 to 11. There are no canals of continuous flow in this district.

C.—Canals of Intermittent Flow.

12. The canals are supplied with water—

(1) (*a*) by means of open cuts to the bed-level of the river in land, following the contour of the country along its bank from the Jayamangali and Suvarnamuki rivers, tributaries of the Northern Pennar, and from the main river (Northern Pennar) also:

(*b*) by means of anicuts constructed across the above rivers to lift up water from 8 to 12 feet according to the heights of the banks;

(*c*) by drawing water into wells sunk at the banks of the rivers, the water therefrom being lifted up by mhote or "kapile";

(*d*) by drawing water during rains from the rivers to feed tanks to serve as storage reservoirs.

(2) In the cases of (*a*), (*b*) and (*c*) mentioned above, the water is distributed to the land by means of channels excavated to the surface-level of the land to be irrigated.

In the case of (*d*) what is drawn through sluices built in the storage reservoirs, to supply irrigation channels made for cultivation below the tank.

(3) (*a*) Except in respect of storage reservoirs, the supply is available in all the three instances referred to in paragraph (1) all the year round in years of ample rainfall. As to storage reservoirs, water can only be drawn to them in the rainy season.

(*b*) In years of scanty rainfall water-supply is available for about nine months in the year.

(*c*) In a year of drought from four to six months in the year.

13. (1) Irrigation increases the value of the produce of lands from 50 to 75 per cent.

(2) If paddy, the increase will be 100 per cent. If sugarcane, the increase will be 400 per cent.

(3) (*a*) If the rainfall is ample and seasonable, there will be scarcely any increase in the case of dry grains; but if it is paddy, the yield may be double.

(*b*) In a year of scanty rainfall the irrigation will give the usual crop.

(*c*) In a year of drought, 75 to 80 per cent. of the crop can be raised by irrigation.

14. (1) By commencing the irrigation too late, its value is diminished by 25 to 35 per cent;

(2) and by too early cessation of the supply, by 50 to 75 per cent.

15. In parts of the Maddagiri, Pavagada, and Sira taluks, irrigation is supplemented from wells.

This is essential because the rainfall in these parts is not ample and seasonable.

16. The approximate estimate of the increase in the total annual value of the produce per acre due to irrigation—

(1) on the average of a normal term of years is from 50 to 75 per cent.; and

(2) in a year of drought it is from 75 to 100 per cent.

17. (1) All canals in the district are the property of Government.

(2) The cultivator pays rent in kind generally to the landlord in the district. The landlord gets half of the produce of the land if under tanks, or self-acting channels, or canals; and one-third or one-fourth, if the cultivator has to lift water from wells, etc. In these cases the landlord has to pay kandayam to Government and to bear the cost of manure.

The net profit to the owner of the land will generally be twice the amount of kandayam.

(3) The water advantage rate paid to Government is generally from two to four rupees per acre in the district.

(4) There are no private canals. The rates to Government are uniformly paid on the total irrigable area in holding. But in the case of lands held by private individuals the rate is paid by the cultivator on the irrigated area.

18. In the case of wells, the owner of the land sinks them at his cost; but the cost of lifting water is borne by the cultivator. As regards irrigation by channels, the water is led to the lands by the cultivators themselves through minor channels (hikals).

Any extra labour devolving upon the cultivator, such as lifting water from wells, etc., is recouped by granting a higher proportion of produce, as already stated in answer to 17 (2). The owner of the land generally bears the cost of preparing the land for irrigation. Sometimes the level of the bund is lowered to the irrigation channel level and the land is terraced to retain water at a uniform level.

19. There are no such cases in this district.

20. Except clearance of silt, weeds, etc., the cost of maintaining the works, in the case of channels, is borne by the Government, and in the case of wells, by the owner of the land.

The cost per acre irrigated is from four to eight annas per annum.

The clearance of silt and weeds has to be done by the cultivators according to rules. But much difficulty is experienced in getting the work done in time, and in some cases the cultivators have themselves come forward to pay the cost at a reasonable fixed rate per acre, rather than doing the work themselves. It is preferable that this work also is undertaken by Government fixing reasonable rates per acre of land irrigated. For this purpose legislation is necessary.

21. There are no private canals.

22. No applications have hitherto been received offering to construct at private cost any canals.

D.—Tanks.

23. (1) By the run-off over the catchment area during the rains. In addition to the run-off from the catchment areas, there are certain tanks which are fed by channels drawn from rivers.

(2) Through masonry sluices constructed in the tank bund, the water stored in the tank runs into the main channel, constructed by Government at Government cost, or at the cost of the owner of the tank, and is led into lands by subsidiary channels excavated by cultivators themselves. The work of letting water into the main channel devolves upon nirgantis appointed by Government, and who are remunerated in kind at a rate fixed by Government by the cultivators of the land, the village revenue officials supervising the distribution of water.

(3) (*a*) In the case of major tanks (yielding more than Rs. 300 revenue to Government) the supply will be maintained throughout the year. But in the case of minor tanks the supply extends from six to eight months.

(*b*) In a year of scanty rainfall the major tanks generally maintain supply for about six months, and the minor tanks for about four months or less.

(*c*) In a year of drought it is only big tanks that have good rainfall catchment basins, and river-fed channels, that can hope to receive and maintain a supply for about six months.

(4) The area ordinarily irrigated from a tank depends upon the rainfall. Not less than 75 per cent. of the lands are generally irrigated in ordinary years.

24. (1) Irrigation increases the value of the produce of the land from 50 to 75 per cent.

(2) If paddy, the increase will be 100 per cent, if sugarcane, it will be 400 per cent.

(3) (*a*) If the rainfall is ample and seasonable, there will be scarcely any increase in the case of dry grains; but if it is paddy, the yield may be double.

(*b*) In a year of scanty rainfall the irrigation will give the usual crop.

(*c*) In a year of drought 75 to 80 per cent. of the crop is raised by irrigation.

25. (1) By commencing the irrigation too late, its value is diminished by 25 to 35 per cent.

26. In parts of the Maddagiri, Sira and Pavagada taluks the irrigation from tanks is supplemented by wells. This is essential because the rainfall in these parts is not ample and seasonable.

27. The approximate estimate of the increase in the total annual value of the produce per acre due to the irrigation—

(1) on the average of a normal term of years, is from 50 to 75 per cent; and

(2) in a year of drought, it is from 75 to 100 per cent.

28. All canals in the district are the property of Government. There are certain private tanks under which lands are held by third parties. The latter pay survey assessment, of which one-fourth is paid to the owners of the tanks.

(2) The cultivator pays rent in kind generally to the landlord in the district, half the produce of the land, if under tanks or self-acting channels or canals; and one-third or one-fourth if the cultivator has to lift water from wells, etc. In these cases the landlord has to pay kandayam to Government and to bear the cost of manure. The net profit to the owner of the land will generally be twice the amount of kandayam.

(3) The water advantage rate paid to Government is generally from two to four rupees per acre in the district.

29. The water of the tank is led into main channels through the sluice and from there it is distributed to the subsidiary channels. The cultivator leads water from the subsidiary channel to the land himself. The owner of the land generally bears the cost of preparing it for irrigation. Sometimes the level of the land is lowered to the irrigation channel level, and the land is terraced to retain water at a uniform level.

30. The maintenance of restored (that is, brought up to a standard of safety at Government cost) tanks devolves, as far as earthwork is concerned, on the holders of the atchkat (that is, lands irrigated by the tank), and also on the villagers that make use of water in proportion to the benefits they derive from it. But the cost of stone and masonry works for sluices, bunds, weirs, etc., are borne by Government. The average

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approximate annual cost of the maintenance will be about four to eight annas per acre. In the case of tanks not brought up to standard, the duty of maintaining it is not laid upon the rayats; it being left, in the case of minor tanks, to their option to do the earthwork, and the Government undertaking stone, masonry and other necessary works. In the case of unrestored major tanks, they are being brought up to standard as funds are available. The system of working it is not unattended with difficulties. In regard to minor tanks specially, some definite ruling or legislation is necessary to save them from further deterioration.

31. The distribution of water of tanks constructed by private individuals is regulated in the same way as in the case of Government tanks. But lands under private tanks are generally in the holding of the owners of the tanks themselves. No difficulties in these cases have been brought to notice.

32. In the case of breached tanks, the restoration of which cannot be undertaken by Government for want of proper return, and if there is no other objection to their restoration, private persons may be allowed to restore them at their own cost on chowthayi tenure as has been hitherto done in parts of the Province.

33. In cases of tanks which do not form part of a serial system, much inconvenience is experienced from their liability to silt up. No regular statistics are maintained as to the depth of silt accumulation. But when the feeder channels run through sandy tracts, which is generally the case with tanks situated close to hills, the silt accumulation is very great, and it may roughly be taken to be half an inch per annum. Silt is not removed. The only remedy adopted in necessary cases is by raising the height of the waste weirs. In a few cases silt traps are constructed above the tank across the feeder streams. Sometimes aloes, etc., are planted to arrest the movement of sand.

E. Wells.

34. (1) In the Pavagada taluk and in parts of Sira and Maddagiri where wells are dug in porous rocky soil, the depth of wells averages from 25 to 35 feet. These wells are called "Tadamu" wells. There are also wells called "Saravu" wells, which are mostly situated in close proximity to jungle streams, and their depth is from 18 to 25 feet. If excavated deeper, the underground current which feeds them is liable to disappear. The latter class of wells sometimes fail after a few years.

(2) The "Tadamu" wells are generally supplied by percolation, and the "Saravu" wells by underground streams. Occasionally underground springs may be tapped.

(*a*) In an ordinary year there will be ample supplies in both kinds of wells.

(*b*) In a year of drought both will ordinarily partly fail. But in the case of "Tadamu" wells further deepening and enlargement improves the supply.

(3) The cost of excavating a well 25 feet × 25 feet × 25 feet, which would irrigate about 3 acres in the case of "Tadamu" wells, would be about Rs. 300. In the case of "Saravu" wells 7 feet × 7 feet × 25 feet, the cost will be the same, as the sides of these will have to be revetted with stones. Such a "Saravu" well can irrigate about 5 acres in ordinary years of rainfall.

(4) I have known wells of these kinds to be existing from twenty to thirty years.

(5) The water is usually raised by "mhote" or "kapile."

(6) The area commanded by a well is 3 to 10 acres according to the size.

(7) One crop, irrigated dry crops such as ragi, etc., is taken over the whole area in the rainy season; but if paddy is cultivated, which is usually done in the hot season, half the area is sown.

35. (1) Irrigation increases the value of produce of land from 50 to 75 per cent.

(2) If paddy, the increase will be 100 per cent.

(3) (*a*) If the rainfall is ample and seasonable, there will be scarcely any increase in the case of dry grains; but if it is paddy, the yield may be double.

(*b*) In a year of scanty rainfall, the irrigation will give the usual crop.

(*c*) In a year of drought and in a year of scanty rainfall, the areas cultivated falling short owing to insufficiency of water-supply the value of the produce will be materially diminished.

36. The approximate estimate of the increase in the total annual value of the produce per acre due to irrigation—

(1) on the average of a normal term of years, is from 50 to 75 per cent: and

(2) in a year of drought, it is from 75 to 100 per cent.

Note.—Although the yield of the cultivated area may show the above favourable result yet as the extent of cultivation in seasons of drought is materially diminished, the net profit to the cultivator will hardly equal to what is obtained in a favourable year.

37. (1) The cultivator pays rent in kind generally to the landlord in the district. One-third or one-fourth of the produce, if the cultivator has to lift water, being the proportion paid to the landlord. In this case the landlord has to pay kandayam to Government and to bear the cost of manure. The net profit to the owner of the land will generally be twice the amount of kandayam.

(2) In the case of wells that existed at the Survey Settlement, water-rate is charged in the shape of enhancement of revenue. But in the case of wells subsequently constructed, nothing is recovered in the shape of enhancement of revenue. The rates to Government are uniformally paid on the total irrigable area. But in the case of the private owner of the land the rate is paid on the irrigated area.

38. (1) No serious difficulties are encountered in excavating wells or in the selection of a spot in the parts of the district where well irrigation is generally in vogue.

(2) Neither is there such a difficulty in the construction of wells as could not be ordinarily overcome. At the commencement of enforcing the scheme of giving assistance to rayats to excavate wells, it was considered necessary to get trial wells bored by Government; but it was found impracticable, and the work was facilitated by leaving the rayats to excavate these themselves; and when on examination these were found to be successful, advances were granted. In the localities where such wells are made, people supply themselves with boring tools, etc. It may however be necessary to assist them to select most likely places where successful borings may be made; and for such purpose, and also for making advances, the appointment of special officers with experience seems desirable and advantageous.

39. I am not in favour of the Government constructing any wells for the purpose, as the only incentive to private parties to work their wells will be removed as they seem to run no loss. I have come across many wells in the Pavagada taluk which are not worked.

40. Temporary wells called "gerese" wells are worked in parts of the district, *i.e.*, in Tumkur, Maddagiri, Pavagada and Sira taluks. In places where they are tapped, they materially help the cultivator in times of drought. I do not think any particular help by Government is necessary in this respect, as the cost is very little; and to my knowledge there has not been much demand for such aid.

Answers to Questions for Public Works Officers.

1. Population, Area, etc.

The (*a*) population and (*b*) gross culturable and (*c*) average cropped areas in each district or division, and the (*d*) area irrigated in (i) a normal year and (ii) in a year of drought by (1) State Irrigation works, (2) private or village works, and (3) wells respectively.

(*a*) Population 678,883.
(*b*) Culturable area 1,407,801 acres.
(*c*) Average cropped area of last three years 819,990 acres.
(*d*) Irrigated area—

(i) In a normal year the area under crop—
  (1) Under State Irrigation works 56,061 acres.
  (2) Private channels 640 acres.
  (3) Wells 15,459 acres.

(ii) In a year of drought the area* sown—
  (1) Under State Irrigation works 51,668 acres.
  (2) Private channels 620 acres.
  (3) Wells 11,493 acres.

* *N.B.*—Of the area sown not more than three-fourths gave any crop. This figure includes "Punjai cultivation."

2. Soils.

General character of the soil. Brief description of each important class of soil and of its distribution over the country. General experience as to irrigation requirements of different soils.

The district consists of eight taluks. The northern portion comprises the taluks of Pavagada, Maddagiri and Sira. In the Pavagada taluk the soils are exceedingly poor and the presence of salt in large quantities renders their cultivation, even with the aid of water, in many places comparatively unproductive. The soils of Maddagiri and Sira are a mixture of red and gravel earth with stone. In some portions of the Sira taluk the soil however is of a good black color.

In the Tumkur taluk the soils consist of red loam mixed with sand. In the south, Kunigal and Gubbi taluks, red soil mixed with sand is also common. It is generally of a superior kind.

The Chiknayakanhalli and Tiptur taluks form the western portion of the district. The soil in the Tiptur taluk varies to a considerable extent in different parts. In the northern part it is gravelly and in the centre and south it consists of red loam with an admixture of sand. In parts the soil is of a dark brown color. A great portion of the Chiknayakanhalli taluk has reddish soil mixed with sand. The rice lands are of a fair quality and the gardens are composed of choice selected bits of the higher class soils.

Red loam requires constant showers to yield a good crop, but *a mixture of red earth with sand or stone retains moisture* longer. Black soil requires heavy showers, whereas black-brown soil mixed with sand on which arecanut gardens thrive requires ordinary rain.

3. Black-cotton Soil.

Experience as regards black soil. Do small tanks constructed in such soil hold water and can high earthen dams be made of it without a masonry core-wall? When the land irrigated is a black soil, is there any demand for water during the seasons of average rainfall or only in case of prolonged drought? In such soil does the irrigated area show a falling off in years of fair or good rainfall owing to slack demand, and is the revenue more precarious on this account than on works commanding other classes of soil? Has there been a desire for irrigation works on the part of owners of black soil; and is the construction of works for such soil considered as remunerative or as important as for other classes of soil?

Small tanks constructed in black soil do not hold water for a long time. The water is soon absorbed and is not much used for irrigation purposes. Such tanks are generally constructed for absorption and retention of moisture to facilitate bed cultivation.

To the best of my knowledge high earthen dams in such soil cannot be made to stand without masonry core-walls.

It is considered disadvantageous to irrigate such lands constantly. In ordinary good years the rayats would rather grow dry grains than paddy (irrigated). If water is available they sow by rotation dry grains and paddy in the rainy season and hot weather respectively. Where the soil is not deep but gravelly underneath, the means of irrigation is more generally availed of for paddy cultivation. In years of prolonged drought water is used for such lands if available to raise "tadi phasal," *i.e.*, dry crop raised by means of moistening the lands.

Whenever there are sufficient number of rayats they generally hold such lands permanently; and in ordinary years of rainfall they raise javari, coriander, onions, Bengal gram, etc., by applying water (though not freely irrigating the land) in hot season. Where by paucity of rayats there is no competition, such lands are thrown up to some extent and taken up again on the fall of rain. This of course refers to wet lands.

The conditions being the same, I don't think the revenue from one kind of soil is more precarious than that from another.

There is not much demand for irrigation works for black soil, and except in seasons of drought, such works are not as remunerative as works on other soils. In seasons of drought, except when the lands are under tanks with almost perennial supplies, such as Aiyanakere and Kadur Madag tanks in the Kadur district, there will be scarcely any water to supplement cultivation of such lands.

4. State Irrigation Works.

Number and description of the State Irrigation works and their total capital cost. Total area irrigated by the works in a dry year, in a normal year. Average annual working expenses and total and net revenue. Are these works to be depended on in a season of drought?

Major tanks, *i.e.*, tanks below which a revenue of Rs. 300 and upwards is realized, 422: Minor 784.

Cost of improvement, restoration, etc., since Rendition up to 1899–1900, amounts to Rs. 22,75,681. Total area irrigated by the works:—in a dry year (1891–92) about 32,000 acres exclusive of punjai cultivation; in a normal year about 56,061 acres.
Average annual expenses for repairs of tanks, etc., Rs. 14,460.
Total Revenue Rs. 4,69,714-9-6.
Net Revenue (in holding) Rs. 4,07,074-14-0.
These works cannot be depended on in seasons of drought.

5. Future Extensions.

Are any new works of considerable size proposed or considered possible in Mysore? If so, in what tracts, and what would be the probable area of new irrigation?

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The following are the works of considerable size considered possible in the Tumkur district:—

(1) Shimsha project: costing about Rs. 18 lakhs, and area to be brought under irrigation is about 26,000 acres.

(2) Right bank channel of Boranakanave dam: costing about Rs. 1,69,805 to irrigate 3,000 acres.

(3) Javagondanahalli project: constructing an ané or reservoir across Boranakanave stream near Javagondanahalli, Sira taluk, and excavating channel from it; costing Rs. 1,62,168 for ané or Rs. 4,61,982 for reservoir to irrigate 4,000 acres.

(4) Honnamachanahalli new tank, Kunigal taluk: costing about Rs. 50,000 to irrigate about 600 acres.

(5) Constructing Heggadahalli tank, Huliyurdurga, Kunigal taluk: costing about Rs. 62,000 to irrigate 450 acres.

(6) Constructing Tumbadi tank, Koratagere Sub-taluk: costing Rs. 1,34,634 to irrigate about 700 acres.

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6. Village or Private Irrigation Works, excluding Wells.

Are there any village or private irrigation works excluding wells? If so, by whom are they constructed and maintained? Number of such works, and aggregate extent of cultivation dependent on them. Is any expenditure incurred by the State on these works or any increase in revenue direct or indirect derived therefrom? Is there any considerable scope for the construction of new works of this class? If so, in what tracts, and what would be the probable area of new irrigation?

There are 124 tanks with a culturable area of 1,477 acres 24 guntas below them in the several Inam, Jodi and Kayamgutta villages in the district. These tanks were either constructed or improved by the owners, on whom rests the responsibility of keeping them up. The State incurs no expenditure on these works nor does it derive any additional revenue direct or indirect. There are about 37 tanks in these villages in breached condition.

Besides these tanks in alienated villages, there are 82 private enterprise and Kodigi tanks in different parts of the district built by private individuals on Chowthayi or Kodigi Inam tenure. They are included in the number of tanks of Government villages. The construction or repair of the private enterprise tanks are attended to by the Chowthayidars, i.e., their owners.

It is reported that there are in different parts of the district about 18 breached Kodigi tanks and 562 old Government tanks either breached or out of repair. In several cases the repairs of the breached tanks are not undertaken by Government, they being considered unremunerative. Such tanks may advantageously be given to private capitalists on Chowthayi tenure, or if necessary on easier terms.

There is not much scope for new tanks of such a nature.

7. Crop irrigated, Distribution and Duty.

What are the crops usually irrigated in each season by (i) canals, (ii) tanks, and (iii) wells? How many waterings do they usually require? During what period is water given out? How is the distribution from (i) and (ii) controlled, and the time for which water is allotted to each cultivator determined? What is considered a fair average duty per cubic foot per second of discharge or per million cubic feet stored, including loss by evaporation, absorption, etc?

There are two seasons, viz., Kartika and Vaishakha. Kartika season commences from Jaishta and Ashadha and ends with Kartika and Margasira, corresponding to the months of July, August, November and December respectively: Vaishakha commences from Margasira or Pushya and ends with Vaishakha or Jaishta, corresponding to the months of December and January, May and June respectively. There is also an intermediate season, "Yedagaru," in which paddy is sown about the end of September and reaped about March.

Kartika crops—

(1) under tanks are—paddy, sosi ragi, *i.e.*, ragi seedlings transplanted, tobacco, and javari; and

(2) under wells—sosi ragi, tobacco, javari, navane and chillies, and sometimes paddy. The supply of water to paddy must be constant for 5 or 6 months. The other crops are irrigated once in 10 or 15 days from 4 to 5 months.

Vaishakha crop under tanks and wells—paddy generally under big tanks and also wells with good supplies of water; under other wells, jolum, ragi, wheat and Bengal gram are generally cropped. Watering interval and duration is the same as above. Under small tanks only one crop, Kartik, is generally taken.

Sugarcane is extensively grown under the Kunigal tank in this district, and in other parts also it is cultivated to some extent. It requires to be watered for about 11 months of a year though at intervals of 15 or 20 days. It consumes as much water as paddy.

Cocoanut and arecanut gardens are under some tanks. The former does not require irrigation, the underground moisture caused by the head-water being sufficient for the same: but as to arecanut gardens, they are watered once in 20 days or so in hot season, and about a unit of water will serve four acres.

The nirgantis generally, and in some cases of large tanks nainegars, control the distribution of water. The nirganti under the orders of the village officers (shanbhogs and patels) opens the sluice and lets water into the main channel from which the land-holders are expected to take the water to their lands.

One unit or 10,000 cubic yards of water is considered sufficient for 1 acre of paddy, 3 acres of ragi, and 6 acres of javari and other minor crops.

The distribution of water by nirgantis in the case of small tanks works well, but in the case of big tanks it has often given rise to much complaint. The distribution is not properly controlled and thereby much water is wasted, so much so that in years of short rainfall (which has unfortunately been the rule of late) the water is exhausted before the crop is matured, causing heavy loss.

Where the lands under big tanks were cultivated under "warram"* tenure they were divided into Kartik and Vaishakha hantahs or portions and they scarcely failed to realize the crop; but since the introduction of money assessment the practice was discontinued and the cultivation of all the lands at one and the same time generally, in the hot season, has conduced to the loss of crop either wholly or in part. Moreover, when the "amani" (warram tenure) cultivation was conducted the distribution of water was strictly supervised by special establishment, and only such extent of land for which the water would suffice was cultivated, leaving the remainder fallow; but under present circumstances this is made impracticable. Hence in years of drought when formerly under the same circumstances a portion at least of wet crop was secured for the country, it is now altogether lost.

There are no canals in the district but there are river channels. The water is made available for cultivation by means of anicuts either directly or by leading the same to tanks. In some cases channels are made directly from the rivers and the silt is removed by the rayats themselves, who make use of the water by mutual agreement according to the areas under cultivation.

* That is, the Government taking half of the produce in lieu of money assessment.

8. Statistics for Typical Works.

Statistical information regarding some of the larger or typical storage works.

(i) *Initial statistics.*

	Boranakanave dam.	Mavathur tank.
Area and nature of catchment	359·5 square miles	93·2 square miles.
Assumed average annual rainfall	20·20 inches	24·48 inches.
Full supply capacity of tank in m. c. feet	2,776 million c. ft.	683 million c.ft. or 2,216 units.
Percentage of capacity on assumed average rainfall	16 per cent.	8 per cent.
Waterspread at full supply	3,395 acres	881 acres.
Maximum height and total length of dam	Maximum 80 ft. to top of wing. Length of dam 238 feet of which 130 feet weir.	74 feet above bed level. Length of bund 943 yards.
Cost of dam, waste weir, sluices	Dam Rs. 2,03,589 Sluices Rs. 11,017	Rs. 2,70,195. Rs. 10,580. Rs. 24,269 (waste weir).
Compensation for land submerged by tank	Rs. 11,178	Rs. 6,502.
Cost of canal and distributing channels	Rs. 35,680	Rs. 30,780.
	Rs. 18,063 miscellaneous	Rs. 20,634.
Total capital cost	Rs. 2,79,527	Rs. 3,62,960.

(ii) *Annual statistics for each year since completion.*

		1897.	1898.	1899.	1900.	1901.
Rainfall of the year—						
Boranakanave	Inches.	19·08	25·19	20·37	22·66	21·44
Mavathur	,,	..	..	..	23·41	25·55
Amount stored during the year—						
Boranakanave	Units.	5,082	3,722	365	919	1,153
Mavathur	,,	..	..	..	664	1,132
Amount run over waste weir—						
Boranakanave	Units.	4,064	..	..	..	..
Mavathur	,,	..	..	..	..	112
Total run-off for the year—						
Boranakanave	Inches.	3	9	1	3·25	2·75
Mavathur	,,	..	..	..	1	1⅛
Percentage of run-off on rainfall of the year—						
Boranakanave	Per cent.	16	36	5	14	14
Mavathur	,,	..	..	..	4·33	6·6
Area irrigated during the year in acres—						
Boranakanave	Acres.	..	..	500	500	500
Mavathur	,,	..	..	..	..	600
Quantity of water, if any, left in the tank at end of irrigating season and available for next year—						
Boranakanave	Units.	10,282	8,138	5,200	2,826	2,076
Mavathur	,,	..	..	..	664	1,796

9. Flood Protection and Drainage Works.

Districts in which flood protection or drainage works are required. Are these of sufficient urgency to be carried out whenever funds may be available, or may they be reserved for the employment of relief labour? Would such works lead to any increase or prevent any loss of land revenue, or are they recommended only on sanitary grounds or as a means of employment of relief labour?

None in this district on an extensive scale. In the case of the Suvarnamukhi River, which runs through the Koratagere Sub-taluk and portion of the Maddagiri taluk, almost on a level with the surrounding country, the protective banks are maintained by rayats. In some cases they plead their inability to do so, and unless repairs are effected at Government cost, the lands may be thrown up, but the loss will be comparatively small.

10. Relief Works.

On what classes of work was relief labour mainly employed during the late famine? Were any new irrigation works commenced and completed; or if not completed, is it now proposed to complete them?

During the famine of 1876-77 the relief labour was chiefly employed on earthwork to old tank bunds, collection of metal to roads, and some sanitary and village works.

Thimmanahalli tank in the Chiknayakanhalli taluk, attempted as a relief work in the famine of 1876-77, was completed in 1889-90 at a cost of Rs. 18,131.

Oral Evidence.

1. Q. (*The President*).—You are Deputy Commissioner of the Tumkur district?—Yes.

2. Q. How long have you been there?—Ten months.

3. Q. Where were you before?—At Hassan.

4. Q. As Deputy Commissioner?—Yes.

5. Q. Have you been for many years in Mysore?—Yes.

6. Q. Are you a native of this Province?—Yes.

7. Q. You say in paragraph 3, talking of black-cotton soil, "it is considered disadvantageous to irrigate such lands constantly, in ordinary good years the rayats would sooner grow dry grains than paddy (irrigated)." Would he sooner have an acre of dry grain than an acre of paddy?—Yes.

8. Q. Would he prefer to irrigate dry grain?—He would take water but not in the same way as for paddy.

9. Q. As a matter of fact below tanks do they grow juari or crops like that?—Yes, they do.

10. Q. As much as they grow paddy?—Yes, in parts of Tumkur they have one crop of dry grain in the rainy season and a wet crop in the dry season.

11. Q. The dry grain gets water from rain?—Yes and sometimes they supplement it from tanks.

12. Q. Is there a large area of dry grain irrigated every year by tanks?—Not in all the taluks, but in the taluks where there is black-cotton soil; not deep but surface black-cotton soil.

13. Q. How deep?—One foot deep.

14. Q. What is below that?—Lime stone.

15. Q. Is there much land where there is that thin layer of black soil?—Under tanks it is common.

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16. Q. You give in your answer to questions under the head of "Future extensions" six projects for your district; we have just been asking Mr. Dalal about them; which is the most important?—The Shimsha is the most important.

17. Q. There are not many wells in your district?—Yes, there are in the northern parts of the district; in Madagira, Powgara and Sira.

18. Q. Are these wells extending?—Yes, we give advances every year.

19. Q. Do the people take their loans readily?—Yes, there is a demand for them.

20. Q. Do the Government give them as much as they want?—We give them two-thirds of what they ask for.

21. Q. In how many years do they repay the loan?—In twenty to thirty according to their request.

22. Q. And the number of wells has increased?—Yes.

23. Q. Do you know how the wells behaved in the famine year?—Some of these wells have been failing but they are deepened; we give loans for deepening wells.

24. Q. Are they in the habit of deepening wells?—Yes.

25. Q. How deep is the water below the surface?—Thirty feet; there are two kinds of wells, one where the sub-soil is sandy, there it is 20 to 25 feet, in porous rocky soil it is 30 to 35 feet. there are wells which have gone to 50 feet.

26. Q. Do they, after tanks have gone dry, continue irrigation by wells?—Yes in the *Vorck*: every tank does not contain lands with wells under them, certain tanks do; second crop paddy is cultivated from wells under such tanks.

27. Q. You say "the Thummanahalli tank in the Chiknayakanhalli taluk, attempted as a relief work in the famine of 1876-77, was completed in 1889-90 at a cost of Rs. 18,131." That is a small tank?—No, it is a big tank. it is one of the larger tanks.

28. Q. It was carried on in 1876-77?—Yes.

29. Q. (*Mr. Higham*) How do the people arrange the distribution of water?—It is generally arranged by an establishment of *nirgantis* under the Patel: he usually issues water in the main channels, in the minor channels the landowner himself has to carry the water.

30. Q. We have been told that, when tanks only half fill or three-quarters fill, they take water for the whole area, the result is that there is not enough and the crops fail?—Yes, the area is not limited by the water-supply in the tanks; formerly half the produce went to Government and half to the ryots and the whole area under the tank was divided into two, in years of short rainfall they used to limit the cultivation according to the water-supply, but now as no remissions are granted every one wants to take his chance and so the whole area is cultivated; they don't generally adopt the old course of dividing the lands into two portions and it has often happened that the water has failed.

31. Q. Can you suggest any way of meeting that difficulty?—I think it is necessary that the Collector of Revenue should have the power in years in which there is not sufficient water in a tank to limit the cultivation to a certain area and give remissions to the other portions that are left fallow by the rayats.

32. Q. Has that ever been proposed?—It has been sometimes asked for by the rayats, as it was for sometime here, a few year after the rendition; the rule was that lands that had not been cultivated owing to want of water should be given one-half remission; in those years rayats used to limit the cultivation but of late such remissions have been refused, because it clashed with the Bombay Revenue system. Since the whole area has been cultivated by the *rayats* they have often lost their whole crop, sometimes three-fourths of their crop.

33. Q. When a new work is made you don't know exactly how much it is going to irrigate?—We calculate an acre for every mut

34. Q. The land is under dry assessment then?—Yes.

35. Q. You put on a water-rate?—Yes, temporary water-rate until the next settlement.

36. Q. How do you arrange to distribute the water in that case?—According to the extent and importance of the work.

37. Q. How do you arrange the distribution of water on new tanks; do the people do it themselves?—The *nirgantis* are paid by the rayats themselves.

38. Q. I suppose every man makes an application to the *nirganti*?—No, the Amildar fixes with the aid of the Mojindar, *i.e.*, Measurer what area is commanded by the tank; that is reported to the District officer and he fixes the rate in communication with the Survey Department.

39. Q. Then distribution is done by the *nirganti*?—Yes, under the control of the Patel.

40. Q. (*Mr. Ibbetson*).—Have you ever known a case where a tank was only half full, and the people left the water unused because they could not agree who was to have it?—No.

41. Q. You say it was proposed to make trial wells by Government, but it was found impracticable, why was it found impracticable?—Because the cost was too great; the rayats themselves did their trial wells much cheaper.

42. Q. Was that in rocky or soft soil?—In rocky soil.

43. Q. What did the Government do? Did they sink a shaft?—They dug a hole 15 to 20 feet deep.

44. Q. And they found the people could do it cheaper than Government?—Yes, and Government work is slow.

45. Q. (*Mr. Muir-Mackenzie*).—Don't you find it difficult to collect revenue from those people who have not received water for their lands?—Yes.

46. Q. Is it necessary to use coercive measures for the purpose of recovery?—No, we try to do it as mildly as possible, but there has been great difficulty in the matter.

47. Q. Are the arrears large?—No, except in extraordinary seasons.

48. Q. When was the last extraordinary season?—1891-92: last year was not a good year.

49. Q. If people could not pay up to time were they allowed to pay in instalments?—The instalments were never for a number of years; they paid in a few months.

50. Q. In answer to Mr. Higham I understood you to say that after estimating the capacity of the tank wet assessment was put on: then does the whole area at once become liable to wet assessment?—No, it is at the discretion of the holder of the land himself; sometimes a work was executed at the request of the rayats and they bound themselves to pay a contribution as well as wet rate after the completion of the works; in which case no discretion was left to the rayats, as soon as water is made available they are asked to pay the rates.

51. Q. But generally until they apply for water a wet rate is not fixed?—No.

52. Q. Once they apply is a wet rate fixed year after year? There are two kinds of rates?—The District Officer can fix temporary wet rates, sometimes. When the rayat agrees to pay permanent wet rates, the officer fixes permanent wet rates and then recovers from him as in the case of other tanks.

53. Q. But where there is only a temporary rate imposed, is that paid by the *rayat* year after year or only when he grows a wet crop?—Year after year until he gives notice that he does not want it.

54. Q. Are such notices often given?—Sometimes when they find difficulty, at first they thought that a certain tank would supply their wants; it is only occasionally there have been cases in which people have ceased to have anything to do with the tank supply.

55. Q. (*Mr. Rajaratna Mdlr.*).—I understand from what you said just now that rayats are not required to put in applications for water every year?—No.

56. Q. What rates do you charge on new works?—One uniform rate temporarily.

57. Q. Whatever crop is raised?—Yes, we have no gradations for wet and dry crops.

58. Q. In the case of sugar-cane don't you increase the rate by 50 per cent.?—No, it is the same rate as for paddy.

59. Q. Are you certain?—Yes, no distinction is made between sugar-cane and paddy land or juari land; no charge is made for a second crop.

60. Q. In paragraph 4 of your first note you say "in the case of tanks constructed on private holdings, there will be no enhancement of revenue during the period of current settlement. This temporary exemption is secured by obtaining beforehand the permission of Government to construct it. So far as I know, lands irrigated under such tanks are only cultivated on 'waram' tenure. I don't think the existing provisions are sufficiently liberal." What assessment is charged on lands irrigated by private tanks?—Dry assessment; at the revision of settlement they will be turned into wet

61. Q. (*Mr. Ibbetson*).—They only pay three-fourths?—That refers to Government breached tanks taken up for repair by private individuals. These private tanks are constructed upon private lands and dry assessment would continue to be paid during the currency of the settlement.

62. Q. (*Mr. Rajaratna Mdlr.*).—After that they will be liable to the full wet assessment?—I think so.

63. Q. A man who constructs a private tank at his own expense is in a worse position than a man who repairs a ruined tank?—Unless some special concession is asked for and given; under the rules he will be in a worse position.

64. Q. He will pay the full rates instead of three-fourths?—Yes.

65. Q. Your proposal is that for thirty years after the completion of a work he should be exempted from enhancement?—Yes, otherwise there would be no incentive to the people to go in for such works.

66. Q. (*Mr. Muir-Mackenzie*).—Is there no general clause in the law exempting improvements?—No.

FORTY-SEVENTH DAY.

Hyderabad, 21st February 1902.

WITNESS No. 43.—MR. P. ROSCOE ALLEN, M.I.C.E., Chief Engineer for Irrigation, His Highness the Nizam's Public Works Department.

Mr. Allen.

21 Feb. 02.

1. Q. (*The President.*)—We wish to get some information as to the present state of protection by irrigation in His Highness the Nizam's Dominions and as to what proposals are under consideration for increasing the protection of the country against famine?—On page 10 of my printed memorandum I have given a statement showing the area under cultivation in the Telingana districts and on page 2, I have given a similar statement relating to the Mahratta districts.

2. Q. Are the tanks, in the Dominions, out of repair?—Yes; all excepting those few which have been lately repaired.

3. Q. By "out of repair" you do not mean silted up?—No. I mean breached or otherwise in an inefficient state. In the Dominions we shall never suffer much from tank silting up as the conformation of the land is such that we can readily raise the bund and so increase the capacity of the tank as the silt accumulates in its bed.

4. Q. How long have you been here?—For the last four years.

5. Q. The last famine was very bad in the Nizam's Dominions?—Yes; the famine of 1309 F. was the worst on record.

6. Q. Was it very bad in Telingana?—The state of actual famine was never reached in Telingana although distress was severe. We happened to have an enormous number of estimates for works ready which Mr. Dunlop, the Famine Commissioner, gave us leave to put in hand and so the necessity of opening famine works on Code rules was averted. Late in the season three test works had to be opened in the Elgandal district in talukas where our programme of work was a little deficient compared with other talukas.

7. Q. You are better able to withstand famine now than you were a few years ago?—Yes; as regards the Telingana districts we have better storage works and a larger programme of work.

8. Q. I notice that some of these tanks depend on catchment areas which can be counted on in case of a failure of the rains?—Yes, especially in the Warangal district there are certain tanks which can be depended on to ensure some cultivation even in the driest years. In most districts in Telingana this will be the case if the schemes I have designed for connecting tanks with the larger local rivers are carried out.

9. Q. Have these schemes progressed far?—We have not completed many schemes as yet, but we have a large number in hand and good progress is being made.

10. Q. Have you any map showing all the tanks in your charge?—The 4-miles to an inch Ordnance Sheets show practically all the tanks; only one or two tanks are omitted. Where a tank is breached it is marked on the map by a line. You see from the map that immediately you get south there are fewer tanks. The system of tanks in Telingana, where there is red soil, is most perfect. The formation of the Karnatic districts is not so suitable for tanks, and the soil is not so favourable for wet cultivation.

11. Q. What measures do you propose for these south-west talukas of the Karnatic districts?—I have proposed to execute the Benoor Channel Project from the Tungabhadra River, the Muski Storage Project is also under consideration. For the rest it is proposed to restore such old tanks as it is considered worth while and execute any new storage scheme which is at all likely to give a good supply in years when the rainfall is deficient.

12. Q. What are the Gungawati channels?—They are two channels originating in the Tungabhadra in the Gungawati taluka of the Lingsugur district and are working most satisfactorily. The lands under them gave a full revenue during the last famine.

13. Q. What is the area irrigated?—The area irrigated in 1309 F. was 3,130 acres.

14. Q. Is it in the valley of the Tungabhadra?—Yes.

15. Q. Is any extension of these channels possible?—I do not think it will be feasible to extend the existing channels much, but if the channels are improved, the cultivation under them can be extended. The water in the channels at present does not do its proper duty; it only irrigates some 30 acres per cubic foot per second of discharge. We have however raised the revenue under these channels from Rs. 35,000 to Rs. 46,000 since the Public Works Department took charge of them. The maintenance and distribution of the water is now entirely in the hands of the Public Works Department.

16. Q. (*Mr. Rajaratna Mdlr.*)—How much has the ayacut under these channels increased?—I do not know exactly; the area has increased more in proportion than the revenue, because the Revenue Department have been lowering the rates. Double crop rates were reduced from 1½ to 1¼ times single rates but, I understand, that this will again be altered. There were 1,100 acres of sugarcane under these channels in 1309 F.

17. Q. (*The President.*)—What is the Moosapett Project?—It is a tank-filling project situated in the Mahbubnagar district. A channel is taken from a local river, an affluent of the Kistna, to fill a large number of tanks. The river runs only during the rainy season and so we can only make use of flood water in this project; after the rains the river rapidly dries up.

18. Q. How much land will the Kistna Project command?—The District Engineer reports it will command 200,000 acres in the Raichur Doab (the country between the Kistna and Bhima rivers).

19. Q. Is there any other project for storage on the Kistna?—There is no project from the Kistna. In its course through the Dominions the Kistna runs in a very deep bed and is very rapid. Where it passes through the Nallamallai hills the gorge is very deep and the current is rapid. The channel from Narainpur (the Kistna Project) is the only feasible project we have.

20. Q. Is it of the same character when it joins the Tungabhadra?—Yes, and the current is so swift that it carries sand in suspension. In the Dominions we have to exercise considerable care in the site we choose for the offtake of a channel from a river; if the offtake is situated where the fall of the river is great and the current strong, the result is much sand held in suspension in the water entering the channel; this is either deposited in the channel or on the rayat's fields, and is, in either case, a nuisance. When deposited in the rayat's fields the outturn of the crop is lessened and the rayat, ignorant of the true cause, says "that the water is not good for irrigation."

21. Q. (*Mr. Rajaratna Mdlr.*)—Is that why the people prefer what they call "black water" to "red water"?—Yes; the black water contains fertilizing silt and the "red water" contains sand.

22. Q. If the Kistna carries sand it will *à fortiori* carry silt?—Yes; such is precisely the case also with the Godaveri. The late Sir Vikar-ul-Oomra repaired an old anicut across the Godaveri to supply water to lands in his *jagir* in Elgadah. I was asked to report on this some time ago. I found the anicut situated half way down a cataract in the Godaveri where, of course, much sand was held in suspension by the water of the river; the fall of the channel was also great and all this resulted in much sand being deposited on the rayat's fields and their usual complaint about the water. This channel passes through several tanks and below the first tank, where evidently the sand in suspension is dropped, the complaints ceased.

23. Q. Have you any other big projects? We are now enquiring into one from the Godaveri.

24. Q. That means a dam over the river; would that be easy?—Yes, the easiest thing possible. The site of the proposed dam is at the top of a rapid and the bed of the river here is sheet rock.

25. Q. You are now in the preliminary stage?—Yes. Like other projects we propose, if the preliminary stages point to the likelihood of success, executing the project by sections. In the Dominions we have no proper idea of the discharge of the rivers at different seasons of the year as

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no observations have, as yet, been made. The only river of which we have any knowledge is the Moosi. Our projects are thus as far as possible designed to be carried out in sections; a second section is carried out if the supply of water proves adequate. Meanwhile, all masonry works which in any way confine the width or discharge of the channel are, in the first instance, made large enough to carry the supply which will be ultimately required.

26. *Q.* Are you now taking gauges of the rivers?—We have now commenced to do so.

27. *Q.* How many tanks have you got in good working order?—I should say about 1,000 major tanks. I cannot say how many minor ones.

28. *Q.* You gave on page 3 of your memorandum a list of tanks which held water during the last famine?—Those are only a few typical cases. With regard to the Avanur tanks the printed figures are wrong. The "free" catchment area should be 1¼ sq. miles and the "combines" should be 4 sq. miles.

29. *Q.* Which of the tanks are in good order?—Certainly not half of them. More than half of them may be yielding some revenue, but they are certainly not in an efficient state.

30. *Q.* What is the exact area under wet cultivation?—We can only ascertain that by finding out the amount of remissions that have been given and deducting this amount from the gross revenue. The remissions are very large at present owing to the large number of tanks which are in disorder. I have not the figures of the remissions with me. The remissions during late years have been very large.

31. *Q.* You have a table on page 10 of your memorandum showing wet cultivation in the Telingana districts. Does that include wells?—Yes.

32. *Q.* As to tank repairs will you be so good as to tell us how they are kept up?—As far as the Major Works are concerned we propose to put the maintenance in the hands of the Public Works Department. I think this will be necessary as the nature of the work necessitates a trained staff being in charge. In the case of tanks, they are given certain definite minimum dimensions such as height of bund above maximum water level, breadth of bund, length of escapeway, etc. It is absolutely necessary that they should be kept up to these dimensions. Again the length of escapeway is calculated on the same empirical formula in all cases and it is at the best approximate. Information is required directly it is ascertained that the allowance made, for the disposal of surplus water, is insufficient. The case of channels is precisely the same and, in addition, a trained staff is further required to manipulate all scouring sluices in channels and so obviate the nuisance from the accumulation of silt in the bed. To execute all this work efficiently it is necessary that the maintenance should be in the hands of a trained staff under the orders of the Public Works Department. Other than this there is the necessity of collecting data for guidance in future designs and which can only be done by a trained staff. I have found from the experience that when maintenance is in the hands of the revenue authorities irrigation works rapidly get into disorder. Especially is this the case when channels are concerned. The channels under the revenue authorities rapidly blossom out into picottahs and unlicensed sluices; below each of these a bund is thrown across the channel and very soon the channel becomes in a most inefficient state. Revenue Officers have often explained to me that if such things are allowed more revenue accrues, but such is not the case as it is done to the detriment of existing revenue. Again when clearing a channel of silt, Revenue Officers never know what width the bed should be cleared to in its various sections. I am decidedly of the opinion that the maintenance of all Minor Works should be in the hands of the village community, or some one interested in the cultivation under it, under the supervision of the Public Works Department.

33. *Q.* Is there any institution here like the *Kudimaramat* in Madras?—There used to be, but it has fallen into disuse.

34. *Q.* You say that estimates, amounting to Rs. 64,68,987 for 538 works have now been sanctioned by your Government. That ought to keep you going for a long time?—The vast majority of these works are already in hand. These estimates refer to Major Works in the Telingana districts only.

35. *Q.* What are you spending now? How much do you propose to spend each year?—I have advised the Government to spend 25 lakhs a year on irrigation works. Last year we spent some 17 lakhs. We have been gradually working up the expenditure. When I came here the expenditure was only 5 lakhs, and I have now worked it up to 17 lakhs which includes expenditure under the "New Scheme."

36. *Q.* (*Mr. Muir-Mackenzie*).—The "New Scheme" expenditure being 5 lakhs?—Yes, about 5 lakhs.

37. *Q.* And you propose that the Nizam's Government should give 20 lakhs a year?—I propose that 15 lakhs should be given from the revenue; 5 lakhs should be raised by loans; and 5 lakhs be expended under the "New Scheme." That is my proposal, but it is not as yet sanctioned.

38. *Q.* (*Mr. Higham*).—In the Mahrattwara districts you have practically no tanks at all?—Very few indeed and those are mostly situated in Nander on the borders of the trapean plateau.

39. *Q.* You have irrigation channels from the Tungabhadra?—Yes.

40. *Q.* There is a good deal of well cultivation?—Yes. I have given the figures in my memorandum.

41. *Q.* You have only river channels in Lingsugur?—Yes, and a few tanks, which latter are in disorder.

42. *Q.* I understand that most of the wet cultivation in the Mahrattwara districts is under wells?—I am not well acquainted with the Mahrattwara districts, but I believe such is the case; Mr. Dunlop will, however, inform you on this point.

43. *Q.* What does the area irrigated by river channels amount to?—About 4,000 acres.

44. *Q.* And what under tanks?—That I cannot tell you. We have a few tanks, but the total area under tanks is not great.

45. *Q.* You know enough about the Mahrattwara districts to state that the area under tanks cannot be large?—I know sufficient to state that it cannot be large.

46. *Q.* So that the irrigation must be mainly from wells?—I believe it is mainly from wells.

47. *Q.* Referring to the three Carnatic districts you say, "Of the estimates prepared by the staff estimates amounting to Rs. 10,53,486 for 39 works have been sanctioned by Government; estimates amounting to Rs. 19,100 for four works are awaiting sanction; and estimates amounting to Rs. 7,56,959 for five works are awaiting the approval of the Chief Engineer." What works are these?—The Benoor Project, estimate Rs. 8,14,000, is one of the sanctioned estimates; and there are 38 smaller works mostly tanks—of which the Sirwall tank costing Rs. 41,000 is the largest.

48. *Q.* I thought you were not doing any tank works?—In the three Carnatic districts we are restoring some of the Major Works.

49. *Q.* Are they filled from the rivers?—No; those we have taken in hand, with one small exception, depend on their own catchment area.

50. *Q.* You are providing two lakhs of rupees for 38 smaller works?—Yes, for major tank repairs.

51. *Q.* And there are estimates for works awaiting sanction amounting to seven lakhs of rupees?—Yes; one of these is for an impounding reservoir in the Muski Valley, a tributary of the Tungabhadra in Lingsugur. The remaining four works are smaller.

52. *Q.* Is it possible to do anything from the Tungabhadra?—There is the Benoor Project; but there is no other proposal. I think that with a sufficient supply of water the area under the Benoor Project might be extended.

53. *Q.* Not anywhere else?—To no great extent.

54. *Q.* What other channels are there?—There are the two Gungawathi channels situated above Benoor; and the Beechal channels situated below.

55. *Q.* Is there no further scope for channels?—I do not think so.

56. *Q.* I suppose that if a large reservoir were made on the Tungabhadra, as proposed, above Hospet, to hold 80 and 100 feet of water, could you improve the area under the existing channels?—The area under Gungawathi and the Beechal channels might be slightly extended, but no new country would be taken up.

57. *Q.* By means, I presume, of a cold weather supply?—Yes, by means of a cold weather supply in the existing channels.

58. *Q.* Would you be able to take off no new channels?—No. In reality irrigation from the Tungabhadra on our side of the river is limited.

59. *Q.* If you could store water could you not extend the area?—I think we should be able to extend it considerably under Benoor, and slightly under Gungawathi and Beechal, making some 8,000 acres in all at most.

60. *Q.* You would lengthen the channels?—We should lengthen the Benoor and Beechal channels. The irrigable land on our side of the Tungabhadra is limited by the conformation of the country.

61. *Q.* What is the Sirwall tank. Is that one of the 39 works sanctioned?—Yes; and it will cost some Rs. 41,000.

62. *Q.* Is there any possibility of having rain-fed tanks in the Mahrattwara districts?—No. I do not think they would be of any use. I propose making large river-fed reservoirs as the desire of the Government is to improve the drinking water supply in the Mahrattwara districts. Mr. Dunlop will tell you more about this than I can. Irrigation under such tanks would have to be encouraged in order that the Government should have some return for their money. In years of failure of the rains the water would be conserved for drinking purposes. There is not likely to be more than 1 or 2 per cent. return on such projects.

63. *Q.* Would you tap the smaller rivers?—We should tap only those which had a catchment area of about 200 square miles at the site of the offtake. There are remains of old works in the Mahrattwara districts.

64. *Q.* Are old works good assets?—Yes,—as frequently we have nearly to fill in a breach to restore a tank to a state of efficiency; in this manner in the Telingana districts we have had very large returns from very small works.

65. *Q.* The only possible new work of a protective nature in the Carnatic is the Kistna Project?—Besides Benoor Project and the Muski Project, both of which are protective, the only remaining large work is the Kistna Project, and this is a most enormous work.

66. *Q.* What area would it command?—The District Engineer in charge reports that it commands 200,000 acres.

67. *Q.* (*Mr. Muir-Mackenzie.*)—Have you thought of a canal on the right bank?—Some few enquiries were made, but the matter was not pushed very far.

68. *Q.* (*Mr. Higham*).—You would require a very high dam?—I do not think so, but the whole project has not as yet been thrashed out. The area of the land cultivated might be limited by the discharge of the river.

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71. *Q.* Would the Bombay works affect the discharge of the Godaveri very much?—No.

72. *Q.* When is the *tabi* crop, sown?—The sowing commences in November.

73. *Q.* For how many months is water required for the *tabi*?—The rice crop itself requires water for three months. If a large area is planted the fields are not sown simultaneously and thus a supply may be required for four or more months to the whole area.

74. *Q.* Would it be worth the while for the Nizam's Government to consider the question of storage in the Kistna river?—So far as I am aware no suitable storage scheme could be devised on the Kistna which would be beneficial to the Nizam's Dominions.

75. *Q.* Is there any site for storage tanks on the Kistna?—It is very rapid all through the Nizam's Dominions, and I do not think we could construct a good reservoir there.

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77. *Q.* In Madras they are discussing the possibility of making a big dam and reservoir, 90 miles above Bezwada. They contemplate making the bund 100 feet above the bed of the Kistna. If that project is carried out will it result in any good to your side?—I do not know the site exactly, but so far as the locality is known to me I should say it would do us no good as the land on our side is high and rocky. I am, however, going there shortly and will enquire into the matter.

78. *Q.* Regarding the Telingana districts. You only repair breaches and put old tanks in order?—Yes; we only repair the old tanks. And the financial results are always favourable.

79. *Q.* Have you any cases of tanks being made *de novo*.—No. We have three such projects; but I do not think they will give such good results as the old ones we have already put in order.

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81. *Q.* I mean storage works.—No. The Muski is the only such project which is fully prepared. The estimated results amount to 16 per cent; but I do not think we shall get more than 4 or 5 per cent.

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83. *Q.* What credit is taken in respect to these works?—We have no particular system of making accounts. We take credit for the whole rise in revenue due to the supply of water.

84. *Q.* You take an average of five years of the previous revenue and credit yourself with the difference?—Yes.

85. *Q.* Don't the Revenue Department make up the accounts?—No. I make them up myself.

86. *Q.* That is an excellent plan. Suppose you have to incur further expenditure on a tank other than originally sanctioned?—That is added to the capital account. Charges for maintenance only are met from the revenue.

87. *Q.* If you make any considerable repair you call it capital?—Yes.

88. *Q.* I think they do that in most Native States. Capital account really includes heavy maintenance?—Yes. We have not introduced any proper system of keeping accounts as yet.

89. *Q.* I want to know what value you attach to these percentages?—Revenue authorities give us the returns, and we also have the returns prior to our taking the work in hand.

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93. *Q.* Do you keep up a record of the behaviour of your large tanks, in regard to dates on which they fill, etc.?—We have not done so in the past; we are practically now only just making a beginning.

94. *Q.* Is any record of the rainfall kept?—Yes; we keep a record and so also do the Revenue Department.

95. *Q.* (*Mr. Muir-Mackenzie.*)—Under the existing state of things are we to understand that the majority of tanks in the Telingana district would dry up in a season of drought?—Yes, as at present supplied by their own catchment areas.

96. *Q.* You think they would not fail if connected with the rivers?—No; not if connected with rivers which have a catchment area of 200 square miles at the site of offtake of supply channel.

97. *Q.* Would that ensure their not failing?—It would prevent absolute failure and would ensure water for irrigation for a considerable area. During the late famine the Avanur tanks in Elgandal irrigated their full ayacut; they are supplied by a channel from the Maner river which has a catchment area of some 900 square miles at the site of the offtake.

98. *Q.* Even were you to have an absolute failure of rain—a rainfall of 10 inches?—We have never had so small a rainfall as 10 inches. The minimum rainfall we have had during the last 25 years is 17 inches. That was in 1899. I find that the supply to tanks is not so much affected by

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the vicinity of hills as by the character of the soil in their catchment area. A catchment area of trap hills and black cotton soil ensures a regular and good supply of water to the tank. I have an instance of a tank in the Indur district, called the Kalvarol tank which has not a very large catchment area (12 square miles), but in the catchment area of which one or two isolated trap hills and a great deal of black cotton soil occurs; the first year we closed the breach in this tank, sugarcane was planted underneath it which speaks well for the rayats estimate of the perennial nature of its supply.

99. *Q.* It is quite otherwise in the Karnatic districts, they are utterly unprotected?—They are not well protected.

100 *Q.* You have two big schemes in hand; one on the Tungabhadra and one on the Kistna?—Yes; but I do not think the Kistna scheme comes within the range of practical politics for the Nizam's Dominions. It is a gigantic affair which will cost a crore of rupees I hope to carry out the Benoor Project, which will irrigate 10,000 acres and the *Maski Project which will irrigate 6,000 acres. These two* will assist in protecting the Lingsugur district.

101. *Q.* Is that all that is possible?—We intend also repairing the existing tanks.

102. *Q* What will that add to the irrigated area?—About 10,000 acres, but that will not be available in famine years.

103. *Q* All that these two schemes will irrigate will be 16,000 acres. The Kistna scheme which will irrigate 200,000 acres is the only *hope for any* real protection?—I am of the opinion that the smaller schemes mentioned will protect Lingsugur.

104. *Q* If the reservoir on the Tungabhadra is built that will play into your hands?—Not very much. The irrigation under Gungawathi Benoor and Beechal channels might be further extended by some 6,000 acres.

105. *Q* Besides these the only material assistance you are likely to obtain is from the big Kistna scheme?—Yes.

106. *Q.* What about the extension of wells in the Carnatic?—I have not studied the subject, but I fear there is little chance.

107. *Q.* The Gungawathi channels have helped in years of scarcity?—During the scarcity of 1897 the Gungawathi channels proved very useful. The work people of 21 villages found work on them during the famine.

108 *Q.* Did the villages under the channels send no one on to relief works?—I cannot tell you for certain, but I am reliably informed that the work people from 21 villages found occupation on the cultivation under the channels.

109. *Q.* The Gungawathi channels irrigate 3,000 acres?—Yes, something under 4,000 acres.

110. *Q.* Can you tell me *something about the dastband* system?—The *dastband* system is employed only for the maintenance of tanks. It is not suited for major tanks as the maintenance of these tanks requires professional knowledge; but the system is well suited for minor works.

111. *Q.* Are the tanks repaired and then handed over to *dastbandars* to maintain?—This has been done in the case of two isolated major works only. For the rest major works when repaired are maintained by the Department. Many tanks which were in an efficient state were given out on *dastband*. In cases where large repairs are required these are repaired by the Government and; during the period of our operations, the *dastband* is suspended and resumed on completion. As regards other inefficient works given out on *dastband* the repairs required to which are not so great, I have recommended to Government that the *dastbandar* must be required to bring them up to standard dimensions within a reasonable number of years.

112. *Q.* Did any *dastbandars* take tanks over in a breached condition?—Yes, they did. The system was not worked properly. As only those tanks which were in a fairly efficient state should have been leased out. The Taluqdars misread the instructions and leased out all sorts of tanks on *dastband*.

113. *Q.* Is not 10 per cent. an enormous charge for maintenance?—Yes, it is. Once the tank is put into good order, the Public Works Department can maintain it much more cheaply. The difficulty lies in keeping up an establishment for minor works.

114. *Q.* But given an establishment do you think it is a good way to keep tanks in order?—I consider the *dastbandar* can only apply to minor works. Given a *dastbandar* interested in the cultivation under the tank, I consider it is a good method, but he must be looked after. If there is no such person available, I would put the tank in charge of the village community.

115. *Q.* How would you look after a village community?—In the same way as we look after a *dastbandar*. If the tank is not repaired we cancel the remissions for the year.

116. *Q.* Does that usually have the desired effect?—Yes; it works well in Indur and Mohdak, but much depends on the individuality of the Taluqdar. The 1st, 2nd, and 3rd Taluqdars are allowed to grant certificates, and these men have the granting of remissions. Some of them grant the remissions without visiting the tanks and merely on the request of the *dastbandars*.

117. *Q.* Would you propose that the certificates should be granted solely by the District Engineers?—I fear they would be unequal to the task. It would require also a large establishment; it would be better to allow matters to stand as they are. But I would recommend a thorough supervision.

118. *Q.* You think that their work should be carefully checked?—Yes, they require to be looked after.

119. *Q.* Of what does the work of maintenance consist?—The work of maintenance generally consists in keeping the bund to a fixed level about the maximum water level and other earthwork.

120. *Q.* Is there any clearance of channels?—Practically none on minor works. But there may be a deal on major works as in the event of a tank affecting the cultivation of two or more villages the main distributary channels are maintained as far as the fields of the last village affected.

121. *Q.* Is there any clearance of prickly pear?—No, We have none here.

122. *Q.* Is there any masonry work?—Practically none. There might be a little dry stone work at times, but you may take it that on the whole the work would be mainly earthwork I have issued certain instructions for the guidance of District Engineers in drawing up plans and estimates for major and minor works which I put in. These instructions are mainly based on Colonel Campbell's instructions for the guidance of the tank maintenance Establishments in Madras: I found these instructions were incomplete and incorrect and so issued these further instructions to provide for what Colonel Campbell's instructions failed. The revenue statement is the basis on which a decision as to the estimate is arrived at. The statement shows the revenue derived for five years before the tank breached or fell into disorder (if possible), and for five years since; also the increased revenue derivable according to the revenue officer's estimate and the Engineer's estimate. As a rule we only spend five years' revenue on a tank.

123. *Q* In these calculations you take the revenue from the net less remissions?—Yes.

124. *Q.* You do this in conjunction with the village officers. You get the figures from the Taluqdar and make up an estimate?—Yes; and if there is any difference we have to correspond with the revenue officers and obtain the final views of the 1st Taluqdar.

125. *Q.* If your figures are accepted you take it that the difference between the old and new revenue represents the results of your operations?—Yes; it enables us to come to some decision as to the value of the new work.

126. *Q.* I suppose there is great difficulty in obtaining sanction to works of a purely protective character?—None of such character have been undertaken. The Benoor Project would be protective as well as productive.

127. *Q.* If the irrigation of 3,000 acres under the Gungawathi channels protects 21 villages, I suppose we may take it that 10,000 acres will protect, in the same proportion, 68 villages. When a tank is repaired I suppose a large amount of waste land is made available for cultivation?—Not much land which was actually waste; but the land which has gone out of cultivation through the tank breaching or falling into disrepair is taken up again. In many cases there is some further extension and then new land is taken up.

128. *Q.* In Warangal where the population is sparse have you found any difficulty in getting wet cultivation taken up?—No. The only place where we have experienced the least difficulty is in Sirpur Tandur. Sirpur Tandur is a remote jungly place and the people are backward and primitive. But in Sirpur Tandur we shall not be able to do very much.

129. *Q.* But you have no fear that in the more developed places all the wet lands will be taken up?—No.

130. *Q.* In regard to the Benoor Project you would not have that fear?—No. But it might take a little longer to get all the lands taken up than in the Telingana districts. In Lingsugur the soil is mixed, black and red. The land would all be taken up eventually but not so soon as were the project situated in Telingana.

131. *Q.* I suppose the black soil districts are hopeless?—It is difficult soil to irrigate. We have in Nander a tank called the Sirala tank under which there is much black cotton soil and we are experiencing much difficulty in pusuing irrigation under it.

132. *Q.* What in your opinion is the cause of this?—The rayats prefer the dry crop on account of the ease with which it can be sown. Black cotton soil is difficult to prepare for wet crops and decidedly difficult to plough for wet crops requiring extra strong bullocks to work the plough.

133. *Q.* Is there any chance of using the water from the Wardha river?—I do not think so. I am only personally acquainted with a small portion of it but I have reliable reports as to the remainder. The conformation of the land on either side is difficult. Part of the Wardha runs through the Sir Vicar-ul-Oomrah Jagir.

134. *Q.* Do you see any fear if encouragement is given to the extension of wells in Telingana that the people will refrain from taking up wet lands under the tanks?—So many questions arise and so much interference occurs with the working of tanks. Last year I found that a man had a channel dug from a sluice in a tank to his well, the water was flowing into his well, and out the other side, on to his lands; this land was, of course, being classed as irrigated from wells. The same man had drained the tank almost dry by letting water to waste out of the sluices in order to grow a *tabi* crop in the bed; the *tabi* crop in the bed was supposed to be under wells, but in reality the water was being supplied from a tank above. *Mr. Allen.* 21 Feb. 02.

135. *Q.* I am speaking of wells outside the area irrigable by tanks?—The instance I have given was situated outside the ayacut of the tank.

136. *Q.* But that was a case of flagrant abuse?—Yes, but I fear that so many such cases would arise.

137. *Q.* What I want to know is, if you encourage the digging of wells outside the ayacut have you any fear that it would discourage people from taking water from the tanks?—The difficulty would arise in the working of the system; so many abuses would arise; if a well were sanctioned to be dug outside the ayacut, it would, if the man were a village officer, probably be dug within the ayacut.

138. *Q.* (*Mr. Rajaratna Mdlr.*)—In calculating the increased area of a new project you say that you take the difference between the "New Revenue" and the former revenue, and that represents the profit. Supposing there was a large area of dry land in occupation don't you exclude the dry assessment and take the difference between wet and dry?—Our system of accounts is very imperfect still. The course you suggest is the proper one.

139. *Q.* In unoccupied waste lands you would take both the land and water rates.—Yes. I think we should credit the whole rise in revenue due to the supply of water.

140. *Q.* With regard to the *dastband* scheme would it not be better to vary the rates of remission for different works instead of having a uniform rate?—That has been recommended by some of the District Engineers.

141 *Q.* (*Mr. Muir-Mackenzie.*)—Have you anything to do with a Famine Programme?—We have no definite orders to compile a Famine Programme. The estimates already sanctioned and those being framed are considered to be more than sufficient to meet any demands that are likely to be made on us.

WITNESS No. 41.—MR. A. J. DUNLOP, C.I.E., Revenue Secretary, Hyderabad, Deccan.

1. *Q.* (*The President*). We have received interesting papers from various gentlemen connected with the Hyderabad State, but we do not know how much attention should be paid to them?—The officers, who have sent in written evidence, have all been specially selected and are qualified to give opinions on the subject of irrigation in His Highness the Nizam's Dominions. Moulvie Abdul Kadir is a Subadar, and formerly Talukdar, who has had many years' experience in the Telingana; Mr. Rai Murlidhar is the Subadar of Warangal and was for a long time on the Board of Revenue; Moulvie Abdur Rahim is Survey Settlement Officer, Shaik Mahomed used to be under me in the Survey Department, but is now Talukdar of Nalgunda; of these Moulvie Abdur Rahim is in Hyderabad now, and if the Commission would like to examine him, he can be asked to appear. He is a reliable and intelligent officer. He is now working in the Nalgunda district.

2. *Q.* Generally speaking the subject of our research in Hyderabad is to find out how far the state is prepared to resist famine and to ascertain what percentage of the country is protected?—May I explain shortly how we stand? The Hyderabad State is divided into two portions, *viz.*, the districts of Mahratwara and Telingana. The former is divided into two divisions, namely, the Karnatic bordering the south-eastern portion of the Bombay Presidency and the North-Western portion of the Madras Presidency. A portion of this tract is in the famine zone where, as in Sholapur, there is a scarcity every few years. In the Mahratwara proper, including Aurangabad and other districts, there have been few famines. We had a very bad famine in Aurangabad and the adjoining districts lately, but these districts have not suffered severely for a number of years previously In 1876 late rain happened to fall in Aurangabad and the crops did not suffer. I generally liken Aurangabad and Parbhani to the Berars.

3. *Q.* (*Mr. Muir-Mackenzie*).—The famine was very bad in the Berars this time?—Yes, but famine is very rare there. Lingsugur and Raichur are situated in the Karnatic, and these districts frequently suffer from scarcity. Yet the rayats are not so badly off as one would expect to find them under the circumstances. Sometimes they get a bumper crop after a year of drought, and they are so accustomed to times of scarcity that when they have a good crop, they store grain for themselves and *karbi* for the cattle against bad times.

4. *Q.* I suppose the population is not very dense?—About 130 odd to every square mile.

5. *Q.* How does this district show up in the census with the rest of the district?—The falling off of the whole Dominions was 3 per cent. I have not got the figures by districts. *Mr. Dunlop.* 21 Feb. 02.

6. *Q.* (*The President*).—You generally have an increase?—Yes, we have an increase from 6 to 10 per cent. ordinarily. In 1900 there was great mortality and besides many of the villagers emigrated during the famine and have not come back. In Lingsugur and Raichur there was general scarcity of drinking water in the villages far from the rivers. Water there is frequently brackish, and the people are in great difficulties about it in dry seasons. In Mahratwara there are, broadly speaking, no irrigation works, the people being dependent on dry cultivation and garden crops under wells. The wells are limited in number. There are no protective measures in Mahratwara against famine We want a survey to see where it is possible to bund up the rivers and *nallahs* to store water. During the last famine we lost over 700,000 head of cattle. Practically there is no protection against famine, we do what we can to get wells sunk. In 1310 Fasli, we gave 4 lakhs for sinking wells. In 1900, 12 lakhs were given as advances for cattle and seed. I should like to explain our system in regard to wells. In Telingana and Mahratwara the land settlements are different. Mahratwara is on all fours with Bombay. There the people may make wells without permission and at the resettlement no increased assessment is taken. The land continues to be assessed as dry land. The rayats are encouraged in this way to make wells. In Telingana the case is different. We have so many tanks there on which we are dependent for revenue that we cannot allow the same favourable conditions, because the wells might compete with the tanks. According to the old system well lands were often assessed at the same rate as lands irrigated by flow from tanks and in one taluka the well rates were considerably higher than the tank rates. Under my advice His Highness the Nizam's Government have introduced certain well rules in the Telingana district which the people have been gradually taking to and which are very much more favourable than the old system. In the last seven years, since the new rules were introduced, 18,502 wells have been constructed.

7. *Q.* (*Mr. Muir-Mackenzie.*)—Is that the figure for Telingana alone?—No, those figures relate to the whole district, but the increase has been largest in the Telingana. I will give you a copy of the statement showing how these

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new wells are distributed. The new well rules which I put in show the following rates :—

Fifteen years dry rates—15 years at double dry rates; and after 30 years full well rates. (Well rates are about half ayacut rates.) We are trying to encourage the sinking of supplementary wells. What we suffer from in His Highness the Nizam's Dominions is the enormous amount we have to give in annual remissions. The revenue of Telingana including wet and dry is about Rs. 1,17,00,000, but every year even in a favourable year we have to give Rs. 20,00,000 remissions. The system is no crop, no revenue. If the rice crops fail, *i.e.*, if there is no water to give the crop, we have to give remissions. If, however, there is water and the rayat does not use it he must pay the revenue. In ordinary years the remissions amount to about Rs. 20,00,000, but in bad years like 1306 Fasli Rs. 42,00,000 were given in remissions, and in the last famine the remissions amounted to Rs. 68,00,000.

8. *Q.* The figures relate to the Telingana district?—Yes, we give remissions every year in Telingana. No remissions are given ordinarily in Mahratwara. We charge a rather high assessment, but do not levy it unless there is a crop.

9. *Q.* (*Mr. Higham.*)—What happens if there is only half a crop?—If there is only half a crop we do not take any notice of the loss. If water is available and it is not taken, the rayat has to pay the revenue. The remissions since 1897-98 have been as follows :—

	Rs.
1897-98 . . .	33,00,000
1898-99 . . .	28,00,000
1899-1900 . . .	68,45,000
1900-1901 . . .	30,78,000

The great difficulty we have to contend with in making up our budget is to know what the land revenue is likely to be. We know pretty well what it will probably be in Mahratwara where we can collect 99 per cent. except in a famine year.

10. *Q.* (*Mr. Muir-Mackenzie.*)—Was the famine bad in this State in 1896-97?—No, we did not experience a very bad famine, it was really only scarcity, late rains just saved the situation.

11. *Q.* Had you any famine relief works?—Yes; a special report on them has been printed. I estimate that we give Rs. 20,00,000 in remissions in an ordinary year. Now what we want is to find some means for storing water in tanks by means of channels. We want to secure a permanent water supply. A great deal has been done in the matter of "irrigation" works since Mr. Roscoe Allen came here, and he has a number of projects in hand.

12. *Q.* Rupees 20,00,000 is 25 per cent. of the revenue?—Yes, about that.

13. *Q.* (*Mr. Rajaratna Mdlr.*)—Are the remissions in Telingana all on wet lands?—Yes, the dry lands in Telingana are treated in the same way as dry lands in Mahratwara.

14. *Q.* Are the average wet rates higher?—We have no wet rates in Mahratwara. In Telingana, the wet rates are higher in some districts than in others. Where the cultivation is good, we have, since olden times, been taking high rates from the rayats; where it is poorer, we charge lower rates. The conditions of land and water are practically the same, but more industry is shown by the people in some districts than in others. This is specially the case in Indur and Mehdak where the rates are highest.

15. *Q.* Is there any difference in the fertility of the soil?—Speaking generally there does not seem to be any marked difference. The difference is more in the style of cultivation.

16. *Q.* (*Mr. Muir-Mackenzie.*)—Do you test your soil in the same way as we do in the Bombay Presidency?—Yes, we have a regular system, and every field is examined. We make a classification of the soil, and fix a water rate, in accordance with the prescribed tables, which we have for our guidance. There is no system of separating land and water rates. A combined rate is charged which includes both land and water cess. The only instance in which we take a water-rate is from *Inamdars* who have freehold land, but perhaps no right to water, or water only for a single crop and not for the second crop. In such cases we take *dastband*, but it is all credited to land revenue. The safest way of showing the result of irrigation works is to take the increase of the revenue from wet land. This is a test of the work the Public Works Department are doing.

17. *Q.* (*The President.*)—You have a great many *Inamdars*?—Yes, we have many *Inamdars* and a great many *Jagirdars* some of whom own whole talukas. Some of the nobles (*Jagirdars*) have very large estates, the revenue from which amounts to about ten lakhs of rupees each per year. They pay nothing to the State, have independent jurisdiction and manage their own estates.

18. *Q.* Nothing is done for them by way of Irrigation?—No, they do it for themselves. I am managing the estate of the late Sir Salar Jung, and we do everything for ourselves.

19. *Q.* In times of famines, do these *Jagirdars* provide famine relief for the people?—No, I am sorry to say they do not. The Government of India has commented on this; I think that some means should be devised so as to bring pressure to bear on them in regard to this.

20. *Q.* Have you no statistics in regard to these *jagirs*?—No.

21. *Q.* Have their rayats any occupancy rights?—Yes, some *jagirs* are well managed. In the *jagir* of the late Sir Vikar-ul-Umrah, and in Sir Salar Jung's *jagir*, there is a regular settlement system. On the other hand, in some of the smaller *jagirs*, revenue is taken in grain; but in regard to larger *jagirs*, the Government system of land revenue has been generally adopted, even though there has not been a regular survey. With regard to the maintenance of tanks, the custom in Hyderabad is peculiar. Here we have revised the old native system of *dastband*. Some years ago, before Mr. Roscoe Allen arrived, I found the revenue from irrigated lands decreasing. The Public Works Department was in a most deplorable state as regards irrigation works, utterly unable to cope with the maintenance of tanks and as a matter of fact, more tanks were being breached than repaired. Under these circumstances, I asked His Highness the Nizam's Government to revive the old system of *dastband*. The tanks were in most cases constructed in olden days by Zamindars, and the object of the *dastband* system was to give them a personal interest in the tanks, so that the repairs would be carried out by them without delay. Since the *dastband* system was introduced eight years ago, we have given out 5,487 tanks affecting an area of 276,000 acres assessed at 29 lakhs and 12,000 on *dastband*. The system is this. The *dastbandar* is a Zamindar or *Rusumdar* (a man who receives cash payments from His Highness the Nizam's Government). In olden days, these men held the offices of Deshmukhs and Deshpondias, *i.e.*, they were the revenue officers in charge of Parganas, and they managed the lands by hereditary right. The persons to whom we have given the tanks mostly are the persons whose ancestors built them. They are men of property and have a personal interest in the tanks, and generally own a good deal of land below them. We give *dastband* at the rate of 8 to 10 per cent., generally 10 per cent., of the revenue, and for this, the *dastbandar* is bound to keep the tank in repair. In introducing the system we meant it to apply mainly to smaller tanks. The scheme has been criticised a good deal, but I believe that Mr. Roscoe Allen is not altogether against it. He has introduced a scheme of annual inspection and report by the Public Works Department, and if the *dastbandar* does not keep his tank in order, he will be come down upon. In my opinion if the *dastbandi* is well looked after the scheme will work well. We have so many tanks that the Public Works Department is unable to look after them all departmentally. There have been instances of whole chains of tanks breaching in heavy rainfall. When one tank breached all below it breached also. The *dastbandi* in such cases repaired the tanks in their charge at once, while some of the other tanks have not been repaired even yet. I consider the *dastband* system a very important one. The orders we have given is that no *dastbandar* is to be paid his *dastband* until his tank is inspected. Some objections have been raised to the Tahsildar's inspection of the tanks. I have made a proposal that the tank should be inspected by the Public Works Department officers or two and three Talukdars within the first nine months of the year, after that whether the tank is inspected or not, the *dastbandar* must be paid. The status of the Public Works Inspecting Officer is generally the foreman on minor irrigation works. He collects the hydraulic data, and sends a report in to the Sub-divisional officer, who, if there is any reason to do so, makes a personal inspection.

22. *Q.* What do you find against the system?—Nothing. It works very well if the *dastbandar* is looked after. In some cases the *dastbandars* spend more money than they get. They are interested in the cultivation under the tank, and therefore keep up the storage capacity of the tank. I feel that the *dastband* is the best system for the

maintenance of tanks. The *dastbandar* is a *watandar* and in almost every case he owns land under the tank which has most probably been made by his ancestors. I attach great importance to the *dastband* system and to the *dastbandar* being a zemindar.

23. *Q.* You mean he must be *watandar*, holding an hereditary office?—Yes.

[*Note on* dastband *promised.*]

24. *Q.* What is this 10 per cent. ?—It is 10 per cent. of the land revenue of the year, and fluctuates every year. In the Madras Presidency, I understand the man gets the *dastbandam inam* whether the tank is working to the full capacity or not. We simply give a commission of 10 per cent. on the land revenue to secure the tank against loss. When we introduced the *dastband* system, we had no separate irrigation department and the Public Works Department neglected the tanks.

25. *Q.* (*Mr. Rajaratna Mdlr.*)—What happens when the tanks get silted up?—That difficulty has not arisen generally, but in some cases we have got over it by giving a grant-in-aid for raising the *band*, which is paid out of the revenue realised.

26. *Q.* (*Mr. Muir-Mackenzie.*)—Do the rayats like the system?—Yes.

27. *Q.* Is the 10 per cent. paid direct by Government?—Yes, it is paid out of the land revenue.

28. *Q.* (*The President.*)—Is there no fear that the *dastbandar* would levy forced labour?—No. No doubt, the *dastbandar* might pay less than the ordinary contractor for his labour, but being personally interested in the tank, the *dastbandar* would put in better material than some of the contractors would do. It was terrible to see the way in which tanks were repaired and breached before Mr. Roscoe Allen came here. The great majority of *dastband* tanks are small ones.

29. *Q.* (*Mr. Muir-Mackenzie.*)—Are *kuntas* given over under the same system?—Yes.

30. *Q.* Does the Public Works Department advise as to the character of the repairs required?—Yes. I would like to explain another measure which we adopted for putting tanks into repair. We found a great many tanks in disrepair, and the budget grant being limited, the repairs could not be undertaken quickly enough. I consequently obtained sanction to a scheme by which the people were allowed to repair a tank under a contract from the Government, on the promise that they would be repaid from the revenue collected under the tank. We get Rs. 10 per acre and more under these tanks, so that the money expended is soon paid off.

31. *Q.* (*The President.*)—You practically say to the man that if he repairs the tank, you would give him so many years' revenue?—Yes. The work cannot be carried out by the Public Works Department in the ordinary way, without drawing on the Government Treasury, to an extent not provided for in the budget. A contractor supplies the money and repairs the tank. He is paid 5 per cent. interest and gets all the revenue from the wet land under a tank until the debt is paid off.

32. *Q.* That is exactly the system the Egyptians have now adopted for their larger works?—Under this scheme, we have repaired 1,472 tanks, the Public Works estimates for which amounted to 42 lakhs. I should explain also that in some cases, where a contractor had not enough capital, Government sanctioned the half cash payment system, half the amount being taken from the budget provision. Of the 42 lakhs estimated, 34 lakhs were provided by the contractors and 8 lakhs by the treasury. Sometimes the contractor is paid off in two to five years. The Kamareddi tank repairs cost the treasury nothing, and now the tank yields a full revenue to Government. It was repaired under this system. Of course, no *sowcar* would accept 5 per cent. interest for his money, but these contractors hold land and have an interest in the tanks. The repairs on this system are always done under Public Works Department supervision and every procedure is followed according to the rules of the department. Estimates are prepared as if we were going to pay cash in the ordinary way, but instead of cash the whole revenue is given until the amount is paid off *plus* 5 per cent. interest.

33. *Q.* Do the big *Jagirdars* follow that rule?—I am trying to introduce the system in the Sir Salar Jung Estate.

34. *Q.* (*Mr. Rajaratna Mdlr.*)—Under these 1,472 tanks what is the area irrigated?—The return prepared does not show the area, but the revenue received from these tanks is 10 lakhs 86 thousand rupees, which has been paid to the persons who repaired them.

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35. *Q.* Considering these deferred payments, and the fact that only 5 per cent. is allowed, don't you think that if cash payments were made, the contractors would be able to do the work for less?—I do not think so. Besides His Highness the Nizam's Government could not afford to give the money necessary for all the works we wished to carry out at the time this scheme was started.

36. *Q.* Is there any case in which a tank has not paid revenue?—I know of no such case.

37. *Q.* (*The President.*)—At the top you refer to a succession of bad years?—Yes, owing to a continuance of dry seasons some contractors could not afford to wait for their money and so they were paid out of the treasury; those are isolated cases. Ordinarily in dry years, contractors have to take their chances of getting a revenue. But they get their 5 per cent. interest eventually on outstanding amounts. Yes, out of 21 lakhs, we paid 10 lakhs 86 thousand last year. The revenue accounts are recorded in my office.

38. *Q.* (*Mr. Rajaratna Mdlr.*)—The wet area is not shown in Mr. Roscoe Allen's report. Have you the figures?—I could give you the figures from my office. The last Administration Report for the Hyderabad State is for four years ending 1307 Fasli. It contains full information in regard to that subject and also to the revenue system.

39. *Q.* Can you form any estimate of the area under irrigation in the *Jagirdars'* estates?—No, the information is not available.

40. *Q.* Do the *Jagirdars'* estates form one-half of His Highness the Nizam's Dominions?—The Census report for 1901 will shortly be out and will probably give all the information required. There are 2,899 *Jagir* villages in His Highness the Nizam's territory. The population according to the figures of 1891 in *Khalsa* was 8,178,952, in the *Sarfikhas* and *Jajirs* 3,357,498. The *Sarfikhas* is mostly in the Mahratwara country. The figures given in Mr. Roscoe Allen's report of the area irrigated do not include the *Sarfikhas* or *Jagirs*. The *Jagir* tenures are various, but there are two broad distinctions, *Mustusna* and *Gair Mustusna*.

41. *Q.* (*The President.*)—Do the people take takavi ordinarily?—No. They do not generally apply for it. They think it is too much trouble to go through the requisite forms.

42. *Q.* Do they look upon it as derogatory?—No, but it is hedged round with too many restrictions and the money has to pass through too many subordinate hands.

43 *Q.* (*Mr. Muir-Mackenzie.*)—Have you tried the system of the Government making the well and charging a wet assessment?—That was our old system in Telingana during the late Sir Salar Jung's time. Money was spent in sinking new wells and the rayats were charged a higher rate, but that was done to a very limited extent, as the Government had not the means to extend the system very largely. Even now we continue to receive applications for the Government to repair wells and charge a wet rate, but we advise them to repair the wells themselves, as the field holder has the hereditary occupancy of the well attached to the field.

44. *Q.* (*Mr. Rajaratna Mdlr.*)—Have you any statistics as to the total number of wells, old and new, in the Mahratwara and Telingana districts?—There were 78,087 wells up to the end of the year 1302 Fasli in Khalsa lands; there are now 96,589 wells.

45. *Q.* (*The President*).—Do they go in much for *kachcha* wells?—There are a great many in the Telingana districts which are only used in dry years.

46. *Q.* Does the list include *kachcha* wells?—The list includes all wells fitted with môts whether *pakka* or *kachcha*.

47. *Q.* Is the water service very deep in this country?—It varies very much. In Telingana water is near the surface. In Lingsugur it is much deeper. In Telingana the average irrigated area is two acres to a môt.

48. *Q.* May we take it that the irrigation is all from wells in Mahratwara?—Yes, nearly all.

49. *Q.* How did the wells behave during the times of drought?—Many of them failed.

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50. *Q.* Was any attempt made to deepen them?—Yes. We started to deepen them, but there was a great prejudice against this measure during the famine. A rumour got about that water was lost by deepening wells and so widespread was this feeling that I cancelled the order for deepening wells that still had a little water in them.

51. *Q.* You lose the spring or something happens to divert the water?—Yes.

52. *Q.* (*Mr. Muir-Mackenzie.*)—Do I understand you to say that in Mahratwara the assessment on wet land does not exceed the dry rate?—This is the case only in regard to new wells. The old wells are assessed at *bagayet* rates.

53. *Q.* (*Mr. Rajaratna Mdlr.*)—Has there been a very large increase in the number of new wells in Mahratwara?—No, not to the extent I expected.

54. *Q.* (*The President.*)—What is the total cultivated area of the State?—On page 28 of the Administration Report, the total cultivated areas are given, and on page 29 of the same report, the total remissions are shown. To arrive at the net area cultivated, we must deduct the remissions from the cultivated area.

55. *Q.* (*Mr. Muir-Mackenzie.*)—Am I to understand that the actual area under irrigation can be arrived at by taking the difference between the cultivated area and the area on which remissions have been granted?—Yes, if you deduct the remissions the balance is the actual area cultivated in the year referred to, but it varies very much on account of the rainfall. In Telingana we are obliged to take the average of several years when making such calculations.

56. *Q.* That is the nearest approximation we can get to the actual irrigated area?—Yes, as a rule remissions are given on wet lands.

57. *Q.* Is Telingana completely protected against any drought which is likely to occur?—No, because if we had a year of serious drought the tanks would be dry. In that case we would be as badly off in Telingana as in the Mahratwara.

58. *Q.* At the same time the Telingana district did not suffer during the last two famines?—No, there was no actual famine there as some rain fell. The distress such as it was was caused by high prices of grain.

59. *Q.* Has there been no famine there since 1877?—No, with one exception, *viz.*, the Nalgonda district In 1876-77 the famine was pretty bad there. In my opinion the Telingana districts are not protected and if a severe drought were to occur, the tanks would dry up.

60. *Q.* But you have always had rain there?—Yes, but the quantity varies. Last year we had to give 68 lakhs in remissions instead of 20 lakhs as in an ordinary season.

61. *Q.* That refers to only half of the State?—Yes, and to some talukas in the Gulberga Division.

62. *Q.* Suppose some of the tanks in Telingana were linked with the rivers by channels, would that not be a great help?—Yes, Mr. Roscoe Allen has some schemes of this nature in hand.

63. *Q.* Do you think that if the tanks were connected with the rivers, they would fill in years of drought?—Yes, we have the Moosi, which should be useful to the Nalgonda district; and Mr. Allen has a scheme for making use of the Maner and Manjira rivers which can always be depended upon.

64. *Q.* On what grounds, can they be depended upon?—Because they generally have water running sufficient at least to fill the tanks in a dry season. In Mahratwara there are no tanks and no large storage works. The Telingana districts are covered with tanks.

65. *Q.* Do you think that there are no tanks in Mahratwara, because there is black cotton soil there?—Yes, to some extent, but the Marathas do not take to wet cultivation like the Telugus, who place great reliance on irrigation. The Marathas will not take up wet lands under tanks in Telingana. This is a peculiar fact. They do not like wet cultivation. In the Berars, where they have tanks, and where I served for fifteen years, they will not use them for irrigation. In Mahratwara, they do not use the tanks, because there is black cotton soil, which in an ordinary year produces luxuriant dry crops.

66. *Q.* The census for Warangal is rather perplexing. The figure shown in 1901 is 11·67 %?—The census enumeration of 1891 is probably more correct than 1881; but the figures are probably not much wrong, as Warangal was very backward some years ago, before the railway was constructed. After the railway was opened, the district made great advances, and indeed was quite transformed, and has now become a most flourishing one.

67. *Q.* But the population is still only 85 per square mile?—Yes; there are enormous areas of forests, where there is little or no population.

68. *Q.* The development of the districts is due to the railway?—Yes, and to the Survey Settlement. In one taluka the Survey Settlement was so successful that increase in revenue in one year mainly by extension of area almost paid the cost of the survey. Many irrigation works have also been restored.

69. *Q.* There was not much restoration before 1891?—No, very l t le.

70. *Q.* In Mahratwara how were the people employed during the famine? Did you have any irrigation works?—No, there were no surveys, and no irrigation schemes ready. No means for making tanks. The Irrigation Department does not work in Mahratwara, so I had no means of employing men on tanks. We had earthworks of two railways and roads. We also deepened one or two village tanks.

71. *Q.* Do you expect to employ famine labour elsewhere?—My idea is that we should have a regular survey made, and make a programme of irrigation works for Mahratwara, where there is a necessity for them, as a protection against famine.

72. *Q.* Is that district not supposed to be hopeless in regard to irrigation works?—I do not think there is a possibility of making very large tanks there; but it is impossible to say without a survey. There is nothing I should like to see famine labour employed upon better than on tank works; but we had no data or anything to go upon during the last famine.

73. *Q.* With reference to what you said yesterday, with regard to less favourable terms for wells being given in Telingana than in Mahratwara; becau[illegible] the former wells competed with tanks, why should there [illegible] liberal terms for wells outside the tank ayacut?—Becau[illegible] population is sparse, and is not e[illegible] for both tanks [illegible].

74. *Q.* It is just [illegible] of sparseness [illegible] population?—Yes, if the po[illegible] is [illegible] sufficient, the[illegible] would be no object in specially [illegible] wells outside the ayacut. It is only in comparis[illegible] the [illegible] Mahratwara that the wells outside the ayacut are [illegible] treated. Compared with the assessment of [illegible] years the present assessment at well rates is distinctly light.

75. *Q.* Are there any supplemental wells?—Yes, but they are used only in bad years when the tanks fail. We encourage the people by charging only the usual half the assessment.

76. *Q.* (*The President.*)—They won't pay that half if they began with tank water?—There are rules laid down on this point for the guidance of officers. If the water supply is generally a mixed source, partly tank and partly well, the Settlement Department lowers the assessment permanently. In other cases the Jamabandi Officer can make reductions under special circumstances.

77. *Q.* (*Mr. Muir-Mackenzie*)—Would you mind explaining the *dastband* system again?—A man guarantees to maintain a tank in good order, and keep it up in its existing state of repair, and in return we give him 10 per cent. of the revenue In some cases of large tanks we consult the Public Works Department and only 7 or 8 per cent. is given.

78. *Q.* Are they handed over in good repair?—If there are small repairs, the *dastbandar* does this, but sometimes we do it ourselves We also have a new scheme under which the tanks are repaired by the Public Works Department. Sometimes considerable improvement in the tank has to be made, and the question arises whether the *dastbandar* should carry it out. In such a case the *dastbandar* is given the option of repairing it. The following rule applies to the matter:—

"The *dastbandar* should be given the option of carrying out the improvements, according to the new scheme, he being repaid the outlay from the revenue of the tank. If he refuses the contract, and if it is desirable that the improvement should be effected, the *dastband* lease should be suspended for the time being, and the work should be carried out through any other person according to the new scheme. When the work is completed and outlay repaid, the *dastband* lease can be revised." This rule was framed in order to meet the cases in which *dastbandars* were given

tanks before the Public Works Department had inspected them. The new rules have now been working since February 1899.

79. *Q.* Are there any tanks not maintained by either the Public Works Department or the *dastbandars*, and what is done for them?—All tanks not maintained by *dastbandars* are supposed to be maintained by the Public Works Department; but they are too numerous to be well looked after by the Public Works Department.

80. *Q.* Do not you think that the tank should be repaired by one or the other?—Certainly, I am strongly in favour of the *dastband* system, as I think that the personal interest of the *dastbandar* in the tank is an important factor and makes him a more useful agent than petty officials of a large department.

81. *Q.* Is not the percentage given very high?—No, it is not too high. The channels under the tanks are kept in repair by the *dastbandar*, who ensures Government also against future loss. One year's revenue from these tanks is equal to 10 years' *dastband* and if a non-dastband tank breaches and is not at once repaired, it can be seen how much revenue is lost.

82. *Q.* Is the supervision of this system reliable?—The system of inspection is complete. It provides for inspections being made by the Assistant Tahsildar, District Engineer or Foreman in the Public Works Department.

83. *Q.* Can the check be relied upon?—The whole system depends on the District officers and the self-interest of the *dastbandars*. If the latter does not keep up the tank, he loses his *dastband* and the water for his fields. When I first came to Hyderabad and for a good many years afterwards in the olden days, little or no notice was taken of applications for repair of tanks, and they remained unrepaired for years greatly to the loss of Government. This does not happen under the *dastband* system.

84. *Q.* The only weak point seems to be that the revenue of the tank is not a very good indication of the difficulty of maintaining it, *i.e.*, a big tank may have a short bund. The bund of a tank, 600 feet long, would cost nothing to repair. On the other hand, a large bund might bring only a small revenue?—No lease is given now without the sanction of the Public Works Department. The Chief Engineer fixes the amount of maintenance, at so much a year for maintenance. The Revenue Department works under the advice of the Public Works Department.

85. *Q.* I understand that you are desirous of extending the wells in Mahratwara. Do you propose to advance money liberally for that purpose?—I hope the people will come forward themselves. We cannot afford in this state to give very large advances. As a matter of fact, we have given large advances lately.

86. *Q.* Would you be prepared to borrow it at a lower rate of interest than you lend?—I do not know what the Financial Secretary will say to that. I would like to see large advances given.

87. *Q.* Do the people take advantage of takavi?—My experience is the same as it was in the Berars, *viz.*, that the people do not like to ask for takavi.

88. *Q.* If you had a special officer to work it, do you think it would be popular?—It might be if we had good men to work it. We discussed the question of Agricultural Banks here some time ago.

89. *Q.* I do not mean anything so large?—We had something of the kind during the famine, *i.e.*, some special officers were entrusted with the distribution of advances.

90. *Q.* If you had the money would you be prepared to go on with it?—Yes, if we had the money, which at present we have not. I would recommend it for Mahratwara as well as for Telingana. In Telingana our great object in increasing the number of wells is not only to protect the country, but also to obviate the large fluctuations in revenue caused by annual remissions. Extension of wells and channels is the only means of obtaining fixity in the revenue in the Telingana.

91. *Q.* Is there any part of the Dominions in which the people put up field embankments?—No, *Asmanidurri* to some extent, but I have not seen the *tals* here you refer to.

92. *Q.* I thought there might be some in Lingsugur?—I have not come across any.

93. *Q.* In Aurangabad there might be room for these?—I do not remember seeing any there.

94. *Q.* You advocate a survey for the purpose of ascertaining good sites for big tanks. You also recommend a survey of the sub-soil water supply?—It is difficult sometimes to find out where to sink a well. After undergoing great expense, no water may be found, or it is brackish.

95. *Q.* (*Mr. Rajaratna Mdlr.*)—In regard to supplemental wells in the ayacut of tanks supposing the tanks are dry, and the crop is raised by the well, what will you charge?—We charge the well rate which is generally half the wet assessment. We never charge for a tank rate when a well is used.

96. *Q.* What assessment do you charge outside the ayacut?—Certain well rates are laid down according to the classification of the soil, depth of water, etc. The well rate, as a rule, is about half of the tank rate. If the well is used annually as a supplement to the tank, the Settlement Officer permanently lowers the classification on which the assessment is based.

97. *Q.* On ayacut wells *jamabundi* is made every year. The well may be used for only a month or for a whole time. If you use it for whole time, it is assessed at half the tank rate. So every year your officers determine for what period the well water was used?—The ayacut land is assessed as tank land unless there are permanently used wells; but the rayat comes forward, says he has used a well. The revenue officers are empowered under certain defined rules to give remissions.

98. *Q.* You said that special facilities are given to the rayat for the construction of wells in wet lands rather than in dry lands. In what way are the facilities greater in wet or in dry lands?—I did not say that they were greater; but as a matter of fact, wells are generally sunk in the ayacut.

99. *Q.* I was under the impression that you said you discourage the sinking of wells in Telingana?—No. In Telingana permission is necessary to sink wells, and after a certain period a well rate is charged on the land irrigated. In Mahratwara no permission is necessary, and no extra assessment is charged for the land irrigated from the well.

100. *Q.* If an application was made for wells in Telingana, do you refuse permission?—No, we never refuse permission.

101. *Q.* Is not the cost of raising the water by mechanical appliances prohibitive?—No, the water is near the surface, and the cost of raising water is not prohibitive.

102. *Q.* Don't you think that the rayat would rather take water by flow than by lift?—Certainly. But if the tank has only a little water, the question of distribution comes in. If the rayat begins cultivation under a tank, he does not know whether he will get water when he wants it most for his crops. If he is using a well, he knows that he can get water for the whole period. This uncertainty regarding the distribution of water under small tanks at least is a factor in favour of well cultivation.

103. *Q.* In Mr. Roscoe Allen's report, on page 11, he says that an expenditure of Rs. 3,96,800 has been made since October 1896, under the head of "Minor Works." Do you find any increase in the area and revenue due to this?—I cannot say whether any increased area would be irrigated. The remissions would be less; but there would be no other figures to indicate an increase in the revenue.

Memorandum by witness on the Dastband *System for the repair of tanks in Hyderabad territory.*

The *dastband* system, which is nothing new, but a revival of the old native system for the maintenance of tanks, was introduced by His Highness' Government at my instance in the year 1887. For the first six years very little advantage was taken of it. The reason of this was attributed by some persons to the offer of 10 per cent. of the revenue being not sufficiently attractive, and one of the Subadars, Nawab Mukhtadir Jung Bahadur, suggested that Government should give 20 per cent. of the revenue to the *dastbandar*. It was evident, however, that the real cause of the system not becoming popular and taking root, was the difficulty experienced in obtaining sanction for any work, each case requiring a plan and estimate, accompanied with a ten years' statement of revenue, all of which had to filter through several offices before sanction could be obtained.

Instead, therefore, of increasing the percentage of *dastband*, I directed attention to simplifying procedure. The

Mr. Dunlop.

21 Feb. 02.

tanks of which there are in all about 18,000, were divided into four classes, *viz.*:—

(i) Kuntas under which the irrigation does not exceed 50 acres;

(ii) Tanks that had not been repaired by the Public Works Department since 1883, or on which the expenditure since 1883, had not exceeded Rs. 3,000;

(iii) Tanks repaired by the Public Works Department since 1883, on which more than Rs. 3,000, but not exceeding Rs. 10,000, had been expended;

(iv) Tanks excluded from the above classes on account of the amount expended on them by Government or of their situation or for any reason that render it desirable that they should be maintained departmentally.

The system of *dastband* was classified under four heads:—

(1) 10 per cent. in cash of the revenue derived from the land under the tank, or *Inam* land of a value equivalent to the value of 10 per cent. of the revenue;

(2) Permanent reduction in the assessment of the land held by the lessee;

(3) Amount expended to be repaid in a certain number of years by deductions from the revenue of the land under the tank;

(4) A combination of the *dastband* and reduced rate system, *i.e.*, reduced rates for a certain number of years and *dastband* for future maintenance.

The conditions 2, 3 and 4 were hedged round with several precautions and required the sanction of higher officials, so that they have not been generally made use of, but the real *dastband* system as shown in the first of the conditions has been largely availed of. Tahsildars were given powers to grant leases for kuntas and Talukdars for tanks under class (ii) provided the ayacut did not exceed 200 acres. Tanks in classes (iii) and (iv) were submitted for sanction to the Board of Irrigation, and subsequently, when that Board was abolished, to the Board of Revenue.

The duties of the lessees or *dastbandars* are:—

(1) In the case of breached kuntas, to commence the repairs after the stoppage of the rains and to complete them before the next monsoon.

(2) In the case of breached tanks, to complete repairs within the time specified by Public Works Department, and not exceeding three years.

(3) To maintain tanks in good order, to clear silt from channels, to fill up holes or worn paths, to clear brushwood and to keep the sluices in good order.

(4) To repair all breaches at the lessee's own expense.

The rules provide for the grant of *dastband* either in cash or *Inam* land. In the great majority of cases cash is given, and this is the system which is most encouraged as there is a greater hold over the lessee. The revenue fluctuates with the extent of cultivation under the tank and as the *dastbandar's* commission is paid on actual collections, he is personally interested in maintaining the tank in a good state. The *dastbandars* are generally the zamindars of the districts whose ancestors mostly constructed the tanks, and if they are not this, they are the Patels or Patwaris of the village, or some person who is interested in the land under the tank.

When I first proposed the introduction of *dastband*, there was no separate Irrigation Branch of the Public Works Department, and the department was quite unfit to grapple with the maintenance of the tanks, nor had it funds to do so. The state of things at that period was deplorable. More tanks and kuntas were being breached than were being repaired. In many cases tanks breached shortly after their repair, and whatever may be thought of the *dastband* system as a permanent one, it has certainly been a great benefit to His Highness' Government in the past in saving much revenue.

Since 1893 when the *dastband* was practically first introduced in its present form, there have been 5,487 tanks leased on the *dastband* system, affecting an irrigated area of 275,989 acres assessed at Rs. 29,12,641.

In working this system to so large an extent as these figures indicate, there have been cases in which either *dastband* leases ought not to have been given without reference to the Public Works Department, or the *dastbandar* has not properly maintained the same, but taken, as a whole, the system has worked excellently and has been a great advantage to Government.

In carrying out the system two points are essential, *viz.*:—

(1) to select the *dastbandars* from the zamindars or watandars of the district, *i.e.*, the old local pargannah or village officials and land-holders;

(2) to have a proper system of inspection.

As regards the latter point the officer who corresponds with the Assistant Collector and the Tahsildar have the power of inspection, as has also the Public Works Department officers and their subordinates in the district. The question as to whether the Tahsildar shall exercise this power has been referred for orders and the matter has still to be disposed of.

I hope that the question will be settled by withdrawing the power from the Tahsildars and ruling that during the first nine months of the year, the Public Works Department can inspect the tanks, but in the case of any tank not inspected within this period by the Public Works Department or the authorised revenue officers, the *dastbandar* will be entitled, as a matter of course, to draw his *dastband* allowance. The Tahsildar, if he has seen the tank, will have power to stop the payment if the tank is in bad order, but he will have no power to make the payment of *dastband* during the first nine months, while he will similarly not withhold the payment in the last quarter unless there are valid reasons for doing so. I hope that this system will be found satisfactory. It gives the Public Works Department every opportunity for inspecting tanks, and if this is properly arranged, each tank may be inspected at least once in two or three years, while, on the other hand, unless he has defaulted, the *dastbandar* will draw his *dastband* allowance even if the tank is not inspected.

Since the *dastband* system was introduced, a special Irrigation Branch of the Public Works Department has been formed and the irrigation is now carried on in a much more satisfactory manner. Still, notwithstanding this, I am strongly of opinion that the *dastband* is the proper system for the maintenance of the many small tanks scattered over the country. The tanks are so numerous, and the area of the country to be traversed is so great, that unless the Public Works Department were to be very largely strengthened in its lower branch, it would not undertake the maintenance of so many small works. And then again I am very strongly of opinion that the agency of the hereditary zamindars and watandars who have large local interests and over whom Government has a strong hand as they enjoy *rusums* and *inams* from Government, is a more reliable agency than that of poorly paid subordinates in a Government Department.

As a supplement to the *dastband* system, we have the *New Scheme*, under which tanks are repaired on the deferred payment system.

This system was introduced at a time when there was a difficulty in obtaining sufficient funds from the Government treasury, and many tanks have been repaired which, otherwise, might still have been in a state of disrepair.

The contractors, who have mostly been local zamindars but may be regular professional contractors, undertake the repairs with their own capital. The works are estimated for, and carried out in all respects, as ordinary Public Works Department works, the only difference being that payments are deferred until the revenue is recovered from the lands irrigated by the tank. For this purpose, the revenue under the tank is assigned to the contractor and is paid to him at each period of collection until the debt is paid off. When the cost of the repairs is liquidated, *plus* 5 per cent. interest, the contractor has no further

claim on the revenues, unless he is also the *dastbandar* when he gets the allowance and undertakes the liability for the future maintenance of the tank according to the *dastband* rules.

In some instances and specially during the late famine, the contractor has been allowed half payment from the Government treasury.

Under this system, the following work has been done:—

Class.	Number of works.	Amount of estimate			Value of work done.	Payments made			Balance.
		Payable from revenue.	Payable from Budget.	Total.		From revenue.	From Budget.	Total.	
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Major . . . (Estimates over Rs. 1,500.)	304	27,61,517	8,80,494	36,42,011	18,90,266	8,78,093	4,09,303	12,87,396	6,02,870
Minor . . . (Estimates Rs. 1,500 and under.)	1,168	5,51,073	14,529	5,65,602	2,91,889	2,08,466	8,188	2,16,654	78,235
Total .	1,472	33,12,590	8,95,023	42,07,613	21,85,155	10,86,559	4,17,491	15,04,050	6,81,105

It will be seen from these figures that 1,472 tanks have been repaired or are in course of repair under this system. The estimates for these works aggregate Rs. 42,07,613; the amount expended up to the end of the last official year was Rs. 21,85,155, of which Rs. 15,04,050 have been paid and Rs. 6,81,105 are due.

Of the payments Rs. 10,86,559 were from revenue and Rs. 4,17,491 from the allotment in the Public Works Department Budget.

Statement showing the total number of Irrigation Wells in His Highness the Nizam's Dominions, with the number newly constructed from 1893 to 1900.

District.	Total to end of 1892.	Total newly constructed from 1893 to 1900.	Grand Total.	Approximate cost of wells sunk since 1893.	Remarks.
1	2	3	4	5	6
				Rs.	
Aurangabad	11,557	1,981	13,538	4,04,300	
Bir	9,547	1,165	10,712	3,26,000	
Parbhani	9,633	468	10,101	64,650	
Nander	3,158	301	3,459	1,03,600	
Gulbargah	3,069	545	3,614	1,91,200	
Raichur	2,597	175	2,772	23,277	
Lingsugur	2,152	225	2,377	78,450	
Usmanabad	5,173	2,018	7,191	5,44,432	
Bidar	2,212	631	2,839	83,100	
Total Mahratwara .	49,098	7,559	56,657	18,18,009	
Indur	1,447	606	2,053	36,430	
Mahbub Nagar . . .	5,355	1,395	6,750	2,36,752	
Medak	1,845	562	1,907	1,28,750	
Sirpur Tandur	170	6	176	600	
Warangal	7,129	1,962	9,091	1,99,325	
Elgandal	7,002	1,585	8,587	1,48,637	
Nalgonda	6,541	4,827	11,368	11,22,725	
Total Telingana .	28,989	10,943	39,932	18,75,219	
TOTAL DOMINIONS .	78,087	18,502	96,589	36,93,228	

Note.—This statement does not include village wells for drinking purposes.

Statement showing the wet area only in His Highness the Nizam's Dominions.

No.	District.	Gross area and assessment of wet land cultivated including remissions.						Area and assessment of remissions, etc.						Remarks.
		1307 Fasli.		1308 Fasli.		1309 Fasli.		1307 Fasli.		1308 Fasli.		1309 Fasli.		
		Area.	Assessment.	Area.	Assessment.	Area.	Assessment.	Area.	Assessment.	Area.	Assessment.	Area.	Assessment.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		acres.	Rs.	acres.	Rs.	acres.	Rs.	acres.	Rs.	acres.	Rs.	acres.	Rs.	
1	Aurangabad . . .	77,013	3,48,757	76,773	3,45,279	76,732	3,45,742	2,371	2,253	2,382	2,264	2,495	2,344	The remissions in the Mahratwara refer mostly to Gulbargah and Raichur where certain talukas resemble Telingana. Being on the borders, the districts are a mixture of Telingana and Mahratwara.
2	Bir	50,962	1,30,528	50,819	1,32,765	50,895	1,33,490	...	...	...	...	...	...	
3	Parbhani . . .	42,197	1,24,674	42,115	1,24,207	42,165	1,24,580	...	...	...	...	1,020	869	
4	Nander	29,508	1,18,742	29,539	1,13,632	28,635	95,518	1,000	2,227	1,019	3,768	1,869	22,294	
5	Gulbargah . . .	26,387	2,25,036	27,616	2,10,468	27,033	2,33,494	3,432	74,484	2,306	5,110	9,684	1,50,033	
6	Raichur	20,747	1,41,389	21,824	1,48,461	21,113	1,43,203	3,431	19,921	1,364	13,889	7,752	72,040	
7	Lingsugur . . .	13,093	80,005	13,101	80,292	13,265	81,208	2,695	1,668	441	1,426	117	2,061	
8	Usmanabad . . .	20,614	57,449	20,614	57,448	20,614	57,449	701	2,029	585	1,952	669	2,014	
9	Bidar	19,410	87,587	19,573	88,916	19,530	88,568	...	...	...	...	...	...	
	Total Mahratwara .	299,931	13,68,067	301,974	13,81,468	300,012	13,52,752	16,630	1,02,582	8,097	73,409	23,716	2,51,355	
10	Indur	69,745	14,39,894	76,230	14,17,226	69,686	14,03,610	5,832	3,28,045	3,839	3,94,556	52,348	12,55,404	
11	Medak	55,497	10,74,057	58,955	11,21,158	68,694	11,77,845	22,626	4,00,542	12,141	3,69,653	54,814	10,42,729	
12	Mahbub Nagar . .	93,918	10,33,539	102,010	10,51,584	98,615	10,08,079	24,467	4,11,507	38,316	5,01,435	65,560	7,30,437	
13	Sirpur Tandur . . .	4,067	32,083	4,206	33,388	3,986	31,571	807	9,208	204	5,701	2,319	26,234	
14	Warangal . . .	163,807	15,07,011	169,397	16,08,237	175,240	16,55,796	50,011	6,29,459	33,858	4,45,354	1,18,206	13,09,493	
15	Nalgundah . . .	135,450	9,88,174	139,153	10,08,728	140,991	10,14,199	1,33,961	4,57,268	63,673	3,54,235	1,68,691	6,75,897	
16	Elgandal	144,918	17,98,869	157,293	19,29,049	149,526	18,48,248	1,12,474	9,28,914	76,164	6,32,283	148,536	15,44,643	
	Total Telingana .	667,402	78,73,627	707,244	81,69,370	706,768	81,39,348	3,50,178	31,64,943	228,195	27,03,267	610,474	65,84,837	
	GRAND TOTAL .	967,336	92,41,694	10,09,218	95,50,838	1,006,780	94,92,100	3,66,858	32,67,525	236,292	27,76,676	634,190	68,36,492	

FORTY-EIGHTH DAY.

Hyderabad, 22nd February 1902.

WITNESS No. 45.—MOULVI ABDUR RAHIM SAHEB, Superintendent of Revenue Survey and Settlement, Hyderabad Division.

Answers to printed questions.

A.—GENERAL.

1. The following answers refer to the district of Warangal in the Dominions of His Highness the Nizam.

I had been the Settlement Superintendent of this district for over 12 years, and the whole district was settled by me. I have toured, throughout the whole district many times, and I know every inch of it.

2. The average rainfall in the district, as gauged in its various tehsil offices and as stated in my Settlement reports, is as under:—

Name of taluka.	Average rainfall for last ten years (1300 to 1309). inches.
Warangal	29·76
Chiryal	28·14
Wardanapet	30·33
Parkal	32·66
Khammamet	36·91
Mahbubabad	30·85
Yellandapad	32 19
Madhra	32·19
Pakhal	37 09
Palwancha	34·31

The average annual fall as shown above is 32 57 inches.

3. Obstacles to the extension of irrigation:

(1) Sparsity of population. One noticeable feature of the district is its general sparsity of population owing to its peculiar natural conditions as will be described later.

The population of the district in the three consecutive census taken in 1881, 1891 and 1901 respectively was as follows:—

Year.	Population.	Increase per cent.
1881	675,746	...
1891	863,129	26·25
1901	952 646	11·67

It is plain from the above that the population increased at the rate of 26·25 per cent. during the decade ending 1891, while the rate of increase during the decade ending 1901 was only 11·67 per cent.

The average population of the Warangal district in the census of 1891 amounted to 87·2 per square mile of the gross area against 151·2 and 151·8 in the adjoining districts of Nalgundah and Elgandal respectively, and the same in 1901 amounted to 97·4 against 169·4 and 143·7 respectively. Warangal is one of the sparsely populated districts of these dominions.

According to the known law of population (the Malthusian doctrine), population doubles itself within 20 to 25 years under certain ideal conditions:—first, the existence of fertile soil producing ample means of subsistence, and second, absence of counteracting influences, such as plague, pestilence, war, famine, and the like. But the case of the Warangal district affords a peculiar exception to the above doctrine, for, even when not arrested by any positive or preventive checks, the increase in its population during the two decades ending 1901 is only 4·09 per cent., that is, in a period which is long enough to have doubled the population under the above doctrine. Thus, the actual rate of increase is so slow and precarious that it must be accounted for by the peculiar physical conditions of the district. The causes for such a slow increase in my opinion are the following:—

(1) The climate of the district is generally insalubrious, and more especially the climate is so unhealthy in Pakhal, Palwancha, Mahbubabad and Yellandapad talukas, that most of the villages thereof are deserted, and large tracts of cultivable lands are lying fallow for mere want of men to cultivate them.

(2) The second cause is the reservation of large tracts of forest lands and the prohibitive nature of the laws of the Forest Department.

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(3) Even in healthy places large areas of land once under rice cultivation, and yielding a considerable revenue, are now lying waste merely for want of proper irrigation; and hence many whose occupation is agriculture have left these places for others where they can live by cultivation.

Thus, if sparsity of population is an obstacle to the improvement or extension of irrigation, it is pre-eminently so in this district. But at the same time, there can be no doubt whatever that improvement of irrigation will increase its population.

3. (2) Insufficient supply of cattle.

There is no scarcity of cattle in this district. There being large areas of waste lands which afford good pasture, cattle are necessarily more numerous here than elsewhere, or than the requirements of the district. But the fact is that many of the indigenous bullocks of some of the talukas of this district being of a specially good breed, they command a ready sale in the nearest British markets and other places in these Dominions, and fetch a large profit to their owners; and hence cattle are regarded more as an article of trade in this district than as a factor of the agricultural stock, for this mere reason that there are not sufficient areas under cultivation to enable the rayats to keep all their cattle engaged in agriculture. The average number of bullocks in the possession of each puttadar is 2 pairs and the average area per each pair is 11 acres, while in the Nalgundah and Elgandal districts the average number of bullocks is one pair each, and the average area per pair 21 and 12 acres respectively. This clearly proves that the agricultural stock is more favourable in Warangal than in the other two districts.

3. (3) Insufficient supply of manure.

Owing to the existence of a large supply of cattle in the district, there is an abundant supply of cattle manure available for cultivation. But since the extent of cultivation in this district is not as it ought to be, a good portion of cattle droppings is left unused. Rice lands are manured once a year or even oftener whenever possible, and the method of manuring is almost the same as in the other places, namely, by folding sheep and goats in the fields and utilizing their droppings for manure.

3. (4) Unsuitability of soil.

The district of Warangal being the type of the Telingana portion of the Dominions of His Highness the Nizam, a continued expanse of soil of the ferruginous species, or as it is commonly called "black cotton soil," is only a rare exception here than the general rule. It is true that patches of regar lie intermixed with soils of other species here and there, but its percentage in each taluka and in the whole district is very low, as shown in the following table:—

Taluka.	Percentage of regar.
1. Warangal	36·93
2. Chiryal	4·93
3. Parkal	4·785
4. Wardanapet	4 01
5. Khammamet	11·22
6. Mahbubabad	1·64
7. Yellandapad	4·73
8. Madhra	15·43
9. Pakhal	46·74
10. Palwancha	15·05
Average	19·76

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Hence, there is very little regar soil in the district that can afford a serious obstacle for the extension of irrigation.

3. (5) Uncertainty of the supply of water.

The uncertainty, or rather the insufficiency, of water-supply, and the consequent loss of cultivation, are phenomena of frequent occurrence in the Warangal district. As far as I have seen, and as borne out by statistics, in every quinquennial period, there are scarcely two years of ample rainfall in the district, so as to give it a sufficient supply of water for cultivation, and what the rayats call water enough always proves little enough. One characteristic peculiarity of this district is that the rainfall here is neither uniform nor even throughout the whole area, one particular part or other getting an extra share of this bounty every year. The result is that the ignorant rayats always over-estimate the supply of water available, and prepare a large area of land for cultivation, without making any allowance whatever for the inevitable loss caused by evaporation, percolation, etc., and without forming an accurate idea of the prospect of the season, and at last when the season fails, as it invariably does in this district, all their labours and money are lost.

To illustrate the above. During the last ten years there were only three, *viz.*, 1306, 1308 and 1309 Fasli, in which the rainfall was scanty, while in the remaining seven years it had reached the usual average of the district. Nevertheless in none of the seven years was rice cultivation just as could be expected, for the rainfall was quite out of season in many places, and rice cultivation had therefore failed there. Again the years, 1302, 1303, 1304, and 1305 Fasli, were exceptionally good for rice in this district; but even in these years remissions had to be granted to the extent of Rs. 6,50,688 owing to a total or partial failure of crops caused by insufficiency of water-supply as detailed below—

Fasli year.	Average rainfall.	Remissions granted.
		Rs.
1302	39·24	3,30,534
1303	43·60	3,16,914
1304	34·65	6,50,688
1305	40·30	6,29,459

Since the sources of irrigation in this district consist exclusively of rain-fed tanks, the only way in which irrigation can be improved here is to repair the existing sources, and lay out new ones wherever they may be required. But even then the uncertainty of the supply of water caused by the caprice of nature may remain unobviated. However, an attempt is being made, with considerable success I may say, to remove this obstacle to a certain extent by encouraging the rayats to sink wells at their own cost on liberal conditions offered by Government.

Too late commencement of water-supply and too early cessation of it are of frequent occurrence in this district; but as far as I can see, neither of these can in any way obstruct the improvement or extension of irrigation.

3. (6) Lack of capital.

All that can be said at present on the subject is that, since the rayats of this district as well as those of the other districts of the Telingana country are proverbially poor, if the improvement or the extension of the sources of irrigation were left exclusively to private enterprise, it can never be done with any success, for during a period of 30 years, for which statistics are available, the rayats have actually made no more progress in improving irrigation than carrying out petty repairs and constructing some minor works.

3. (7) Fear of enhanced assessment.

The revenue settlement in these Dominions is based on the rayatwari system, and is subject to periodical revision, now once in 15 years. Although in the district of Warangal the original settlement itself is yet to be completed, and there have, therefore, been no instances of enhancement of rates during revision owing to improved irrigation or cultivation of more valuable crops, still the system adopted in the case of a few talukas that had recently been resettled in Mahratwara clearly shows that there is no fear of an enhancement in the assessment on improvements made by the outlay of the rayats' own labour or capital. The lands are not to be re-classed during revision, and the Government simply comes in for a share of the "Unearned Increment," that is, profits accruing to the rayats from causes that are quite beyond their control. Thus, there is a perfect security to the rayats as far as enhancement of the assessment is concerned, and they are allowed to enjoy the full benefits of their own improvements ever and for ever.

3. (8) The territory of His Highness the Nizam, like the other parts of India, is pre-eminently a country of Peasant Proprietors with small holdings, and its agricultural interest is therefore of considerable importance; and the district of Warangal is no exception to the general rule. All cultivated and cultivable lands are property of Government, and lands are held by peasant cultivators under what may be called "the Survey Occupant's tenure", and there are no restrictions whatever on the universal freedom of contract. No registered occupant can be ousted from the possession of his holdings as long as he continues to pay his assessment regularly to Government, and there are no coercive sales of lands except under distress for arrears of revenue, or under the orders of a Court of Justice to discharge a liability imposed on the land by the voluntary acts of its owner. Thus, land-tenure is perfectly secure, and there is no uncertainty in it that might afford an obstacle to the improvement of irrigation.

There is no Tenancy Law in these Dominions enacted by the Legislative body. All questions relating to tenancy are considered then and there by Government, and disposed of in General Circulars or orders. Thus, the Tenancy Law of the country consists of a few Circulars, etc., issued by Government from time to time.

3. (9) *Other reasons.*—Among the various other causes that tend to obstruct the improvement of irrigation in the district I may mention:—

(i) Unevenness of the surface. The district of Warangal is remarkable for huge rocks and hills which render its surface extremely undulating. In almost every village of the district, a portion of the land has to be left uncultivated owing to the presence of these rocks and high grounds. Hence, any improvement of irrigation can only be local, and none can be devised so as to benefit the whole district at once.

(ii) The second obstacle in the way of improving the irrigation of the district is the want of a river or a perennial stream that can afford an infallible supply of water. No doubt, the Godavari runs alongside the whole of the eastern boundary of the district, but its bed is so low that its water cannot rise to the surface of the country except by some extraordinary contrivance.

Further, even if the water were brought up to the level of the surface, it cannot flow through, because the surface is very uneven and full of dense forests for miles together.

Thus, such an attempt may produce some success, but this success can never be proportionate to the troubles of the undertaking.

4. There are some irrigation works constructed by private capital in this district by the rayats at their own cost. During the last 30 years, for which statistics are available, about 22,206 acres of land yielding an aggregate revenue of Rs. 1,45,156 have been brought under irrigation by works of this kind. As a special concession granted by Government, such rayats, already paying dry rates on these newly irrigated lands, will continue to pay them for a fixed period varying from 30 to 40 years.

This system has been modified and a uniform "Kowl System" (the lease of cultivated and culturable waste lands) has been introduced. Under this system dry lands are converted into wet at the rayats' own expense by sinking wells and repairing minor tanks, and the concession allowed by Government to such rayats is that, for the first 15 years of the lease, they only pay the usual dry rates, and for the next 15 years double the said rate; and after the expiry of 30 years, which is the maximum period allowed for leases of this kind, the improved lands are assessed at the usual wet lands.

The procedure adopted in granting kowls is that the kowldar first applies to the local revenue authorities, specifying the lands which he intends taking up; and when the application is finally sanctioned, a kowlnamah (lease-deed) is issued by competent officers setting forth the various conditions on which the lease is granted, and this lease-deed is, as it were, the kowldar's sanad.

The provisions made by the Government in this behalf are liberal enough, but the period of 15 years allowed for such leases generally proves insufficient, for, in many cases especially in these hard days of famine and uncertain monsoons, this period is too short for the rayats to recoup their capital in full. I am therefore of opinion that the dry rates should be levied for the full period of 30 years instead of levying them only for the first half and doubling them for the second half of the said period.

5. There is no law in this country regarding the payment of loans to the rayats for the purpose of improvement of lands, similar to Act No. XIX of 1883 of the Government

of India, and herein lies the fundamental cause of the general poverty of the rayats. For want of proper encouragement from the Government, the rayats are under the painful necessity of borrowing money from local usurers whose rate of interest is abnormal and who most mercilessly squeeze out even the last pie that the rayats can afford, in some form or other. The result of this is that the rayats are always in debt, and so poor and so devoid of all staying power, that they succumb on the very first approach of an unfavourable season. Since a strong peasantry is alone the backbone of a good Government, it is very necessary that the Government, in its own interest, should endeavour to relieve its subjects from their miserable condition, for, as has once been remarked by an illustrious native genius—"the elements of national prosperity are wanting in a country whose principal resource is agriculture, and that agriculture is in the hands of a thriftless and poverty-stricken peasantry;" and John Bright would say—"if a country be found possessing a most fertile soil and capable of bearing every variety of production, and that notwithstanding, the people are in a state of extreme destitution and suffering, the chances are, there is a fundamental error in the Government of that country."

I am therefore of opinion that the want of an Agricultural Bank, or some Law for paying loans to agriculturists for land improvement, is very keenly felt in these Dominions, and the Government cannot therefore attend to this important subject one moment too soon.

6. There is no fear of any extension of irrigation tending "to injure the remaining cultivation by attracting its cultivators to the irrigated tracts." There is an ample supply of agricultural cattle in the district, there is a large quantity of manure available, and the chief occupation of the people is agriculture; and hence, the rayats of this district always want more land for cultivation, and there is therefore no fear of their relinquishing their present holdings and taking to the cultivation of newly irrigated lands. Further, experience clearly shows that, in addition to cultivating the lands already in their possession, the rayats of this district have not been hesitating to carry their agricultural stock even to distant parts and there cultivate new lands whenever available. For instance, the Ghanapur tank in the Parkal taluka, lying as it does amidst thick forests and jungles and in a most unhealthy locality, had not even an inch of land irrigated under it when it was in a dilapidated condition. But nevertheless, as soon as it was repaired and restored to its proper condition in 1305-1306 Fasli, nearly a thousand acres were applied for and taken up for cultivation, and a large number of applications had to be rejected simply for want of sufficient lands to meet the demand.

Again, even the Pakhal lake, its proverbial unhealthiness etc., notwithstanding, is not without attraction; large numbers of cultivators go with all their agricultural stock from long distances to this unhealthy region, simply for cultivating the lands under it. Thus it is plain that a good supply of water is all that is wanted in this district to bring even the worst lands under cultivation.

Want of proper irrigation is the common cry throughout the whole of the Warangal district. In my periodical tours as a Settlement Officer in the various parts of this district, I spared nothing to induce the rayats to take up waste lands for cultivation, but improvement of irrigation is the condition precedent to their undertaking; and this fact has been referred to in many of my settlement reports.

B.—Canals of continuous flow.

7, 8, 9, 10 and 11. There is no irrigation under "Canals of continuous flow" in this district.

C.—Canals of intermittent flow.

12. (1) There are two kinds of canals of intermittent flow in this district, first, those that issue from big tanks, and of which some are even called rivers, such as the Pakhal river issuing from Pakhal lake, the Laknawaram river issuing from the Laknawaram tank, and the river Moranchu issuing from the Ramappa lake and so on; and the second kind of canals are mere hill-streams which irrigate some rice lands in their course, as is found in the taluka of Pakhal, etc.

12. (2) The water of the canals is diverted into small irrigation channels by means of anicuts or temporary dams thrown across them, and through these channels it is carried to rice fields.

12. (3) (*a*) In a year of ample rainfall, the supply of water in the first kind of canals lasts throughout the year, and the supply in the second kind lasts throughout the rainy season only.

(*b*) In a year of scanty rainfall, the first kind of canals contains water for the whole of the first crop, and perhaps a small supply of it for the subsequent crop too; whereas the hill-streams become quite precarious.

(*c*) In a year of drought, the supply of water runs short in both kinds of canals.

13. (1) One peculiar feature of the system of assessment in this district is that its first crop called Abi or winter crop, and its second crop called Tabi or summer crop, are assessed alike, and that, if two crops are raised on one and the same land, the total assessment leviable for both crops is 1½ times the assessment for a single crop of rice, and the average value of the produce per acre is increased in the same proportion, *i.e.*, 50 per cent. more than that of the single crop. But since the above canals depend entirely on rainfall, and great inconvenience and difficulties are experienced even in raising the first crop under them, no hopes could be entertained of reaping two crops under such precarious sources of irrigation. The only increase that could be expected by improvement of irrigation under these canals is that waste lands amounting to 1,610 acres, bearing a revenue of Rs. 14,390, will be absorbed under cultivation.

13. (2) The valuable crops such as sugar-cane, etc., could not be raised under these canals, the supply of which is uncertain as stated above. Hence, the increase cannot be estimated.

13. (3) (*a*) In a year of ample rainfall, irrigation increases the revenue in three ways, namely—

(i) by increasing the quantity of produce which an acre of land ordinarily yields;

(ii) by tending to bring a considerable area of irrigable waste lands under cultivation; and

(iii) by enabling the rayats to raise two crops instead of one in suitable places. The increase in the value of the produce in such a rare bumper year generally ranges from 40 to 50 per cent., when compared with the produce of a normal year.

(*b*) In a year of scanty rainfall, the produce of land is bound to decrease in proportion to the scantiness of the water-supply. It is a matter of every day experience that, whenever the rainfall is scanty, it is also often irregular, so that a fall out of season completes the destruction begun by its absence when actually required. An accurate estimate of the loss caused by scanty rainfall is not quite possible at the present moment; but, however, the loss is generally found to vary from 50 to 75 per cent., when compared with the produce of a normal year.

(*c*) In a year of drought, the cultivation of wet crops is out of the question and hence the loss amounts to cent per cent.

14. (1) and (2) Too late commencement and too early cessation of water-supply are injurious to cultivation, and the loss of revenue arising from the former may be roughly estimated at 30 per cent., while the loss from the latter amounts, in many cases, to cent per cent.

15. As stated above, there are two crops raised on irrigated rice lands. In raising the first or the winter crop, the water required is drawn partly from these canals of intermittent flow, and partly from the rain direct, and hence, there is no necessity for supplementing the irrigation from wells, as far as this crop is concerned. But the case of the summer crop is somewhat different; for during the hot season, these canals cannot be very much depended upon, for the very tanks from which they take their rise, run short and a good deal of the irrigation is therefore obtained from wells; and since this difficulty is, to some extent, peculiar to this district, the number of such auxiliary wells is more numerous here than elsewhere. The number of these wells under tanks and canals in this district is 7,807 against 3,000 in the Indur district. However, although what has been stated above points to the general practice obtaining in this district, a winter crop under wells is not a thing unknown here.

16. (1) The average commutation price of the yield per acre of dry lands, as actually ascertained by crop experiments, amounts to from Rs. 6 to Rs. 10, and that from an acre of irrigated rice land ranges from Rs. 26 to Rs. 35, so that the increase in the yield per acre brought on by irrigation amounts to from Rs. 20 to Rs. 25.

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The actual annual average yield per acre for a normal term of years, say for the five years ending 1305 Fasli was as follows:—

	1301F.	1302F.	1303F.	1304F.	1305F.	Average.
						Rs.
Dry .	10	6	6	8	10	8
Wet .	26	35	35	31	26	31

(2) In a year of drought, there may be dry crops grown to some extent, but the cultivation of rice, which solely depends upon water, is impossible, and hence, no comparison can be instituted in such a year.

17. (1) The system of settlement followed in these Dominions is to assess all wet lands at one consolidated amount, which consists of the assessment of land and water, and there is therefore no separate water-cess that can be definitely calculated. Further, the Government is the ultimate owner of all lands, and all sources of irrigation (except those that have been constructed by private capital) are its own property; and hence, every kind of assessment, namely the assessment on land alone, as in the case of dry lands, and the consolidated amount for land and water as in the case of wet lands, goes to Government. There is no Canal Company here to which any water cess is paid.

The only instance in which a distinct water-cess is paid to Government is the case of Inamdars, etc., who are charged for the water supplied to them by Government, at the rate of Rs. 1-14-0 per acre for the winter crop, and Rs. 3-2-0 for the summer crop, making up a total of Rs. 5 for both crops of rice.

(2) The district of Warangal has been regularly settled and the settlement rates have been guaranteed for a period of 15 years; and hence, the Government (the ultimate owner of lands) cannot claim any enhancement of rent due to irrigational improvements carried on during the continuance of the said guarantee. The Government of course reserves to itself the right of claiming an extra benefit for its own works, that is, if dry lands are converted into wet, or single crop rice lands into double crop lands, owing to the improvements introduced by Government, then the lands are assessed then and there according to their improved quality. In no case, however, can the maximum rates once guaranteed be enhanced before the expiry of the period of guarantee.

(3) The only instance in which the owner of the land pays water advantage rate to Government is the case of Inamdars, and this has been explained under paragraph 17 (1) *supra*.

(4) There is no Canal Company in this district, and there is therefore no royalty paid by it to this Government.

The levy of the wet rates above referred to, either in whole or in part, is governed by the following circumstances, namely:—

(i) if water were available only for the portion that is actually cultivated, and the remaining lands have to be left uncultivated for want of water or owing to the insufficiency of the supply, then the rate of assessment is levied only on the portion that is actually under cultivation; but

(ii) if the whole or any part of a holding is left uncultivated for any cause other than the insufficiency of water-supply, then assessment is levied on the entire holding as if the whole of it were actually cultivated.

18 The expenses of bringing water to the fields and of preparing the land for irrigation, form two factors in the cost of production, and these expenses are borne by the cultivators and not by the Government. They only amount to a small sum and yet they are duly taken into account in calculating the expenses incurred by the rayats.

Security for recoupment.—The expenses of cultivation are first of all deducted from the gross income derived from an acre of land, and out of the remainder a further deduction of 10 per cent. is made for causes beyond the control of the rayats, and out of what then remains, the Government generally takes one-half for its own share of the land revenue, and this rate is guaranteed for a fixed period of time. Thus, the balance from which the rayats pay their assessment to Government excludes the expenses they have incurred in bringing water to the fields, in preparing the land for irrigation, and the like.

19. Want of manure tends to cause earth-butchering, and if the same state of things continues for two or three years consecutively, the soil completely loses its fecundity and has to be ultimately thrown out of cultivation.

Too profuse and too frequent irrigation greatly damage the crops: the seedlings become stunted, and they do not grow as under normal irrigation. In the case of water-logging, the roots of the plants generally decay, and the crop ends in a failure. Salt efflorescence, commonly called *kari* in these parts, is the result of too profuse an irrigation in *regar* lands under rice. This kind of soil is less porous and more retentive of moisture than the ordinary *chilka* land, and there seems to be something peculiar in its chemical composition (which has not been ascertained), which aids the formation of salt when water remains on it for a long time. The rayats suggest that profuse manuring is the only remedy for this defect. But by actual experience, this has been found to be only a partial remedy, for, even when properly manured, such lands yield only less, say from 20 to 50 per cent. less, than others without this defect. In my opinion, frequent renewal of the soil followed by profuse manuring may tend to remove this defect completely.

20. The cost of the maintenance of these canals is borne by Government, and the average expenditure of such maintenance per acre cannot even be roughly estimated now for want of necessary statistics.

21. There are no canals constructed by private persons in this district, and hence the troubles and difficulties experienced in regard to the supply of water, etc., are unknown here.

22. I am not in favour of encouraging the construction of new canals by private persons, and there are but very few cases where such canals could be introduced. But on the contrary, I would strongly recommend the restoration of old anicuts which have been lying in a ruinous condition for many years past.

D.—Tank.

23 (1) The tanks in the Warangal district are generally rain-fed tanks, though a few of them have artificial feeders.

(2) The water is distributed to fields by means of channels and sub-channels that issue from sluices of tanks.

(3) (*a*) In a year of ample rainfall, the water is maintained in the tanks for a period of ten to twelve months.

(*b*) In a year of scanty rainfall, if the season commences early, water is maintained only for three months, and it is just sufficient for the Abi or winter crop. But if the season commences late, the water remains for four or five months, and in this case, the Tabi or summer crop is benefited.

(*c*) In a year of drought, there is no water to be maintained.

(4) The extent of irrigable area under tanks depends chiefly on their capacity. In the Warangal district, this area varies from 50 to 500 acres, and some of the largest tanks in the district, namely, the tanks of Nagaram, Pukhal, etc., irrigate to an extent of 4,000 to 8,000 acres respectively. The average irrigable area is 125 acres under each tank.

24. As explained under canals (question 13), if two crops are raised instead of one, 1½ times the assessment of the single crop is only levied by Government, and the increase in the average value of the produce is also reckoned 50 per cent. more than that of the single crop. There are already 93,689 acres of single crop rice lands under tanks yielding an actual revenue of Rs. 8,90,193, and there are also 23,084 acres more which are now lying fallow simply for want of proper irrigation. Thus, if irrigation were improved, these waste lands would also be taken up for cultivation, and the total revenue to Government will then amount to Rs. 10,84,680. This figure only represents the income derived from a single crop of rice, and if irrigation were so improved as to convert all the single crop lands of the district into double crop lands, there will be a further addition of one-half of the said amount. But this cannot be done; for, my long experience of the district warrants my conviction that the double crop will never increase by such rapid strides as to cover every inch of land available for the purpose. In my opinion, the present area under double crop which is 13,089 acres, may, at the most, be doubled. In this case, the probable addition to the revenue will only amount to Rs. 1,00,000.

(2) The only crops more valuable than rice that are generally raised on irrigated lands in the Telingana

country are sugar-cane and betel-leaves, of which the former is an eighteen months' crop and assessed at double or treble the maximum rate fixed for a single crop of rice and the latter at 1½ times the said rate. These two crops require at least twice the usual supply of water required for a single crop of rice. But in a district like Warangal, where the sources of irrigation are so precarious that thousands of acres of single crop rice lands are lying fallow for want of proper irrigation, the cultivation of crops, such as sugar-cane and betel-leaves which require more water than rice, is quite out of the question. However, it may not be out of place to mention here that, out of a large area of 152.038 acres of Government irrigable lands in the whole district the area under sugar-cane is 110 acres and betel-leaves 12 acres only. Thus it is clear that the cultivators here are not disposed to cultivate valuable crops as has been the case in the other Telingana districts of these Dominions. Perhaps, improvement of irrigation may tend to change the aspect of the district by inducing the people to take to sugar-cane and other valuable cultivation, and if so, as has been already explained, the profit arising from this cultivation will be more than double that derived from a single crop of rice, for every acre of land that might be brought under this cultivation.

The answers to questions 3, 24, 25, 26, 27, 28, and 29 are the same as those to questions 13, 14, 15, 16, 17 and 18.

30. There are two ways in which the maintenance of tanks is provided for,—

(i) under the direct management of Government; and

(ii) through private agencies under what is called the *dastband* system, as described below—

(1) 'By *dastband* which may be given in the shape of Inam land at the rate of one-tenth the area of land irrigated by the tank, or in cash at the rate of one-tenth of the revenue (exclusive of local funds) derived from the land under the tank.

(2) 'By a permanent reduction in the assessment of land held by the lessee.

(3) 'Amount expended to be repaid in a certain number of years by deductions from the revenue of the land under the tank.

(4) 'A combination of the *dastband* and reduced rate systems, *i.e.*, reduced rates for a certain number of years and *dastband* for future maintenance.'

The above *dastband* system works satisfactorily, and there is therefore no need of any further legislation.

31. The answer to this question is the same as that to question 21 *supra*.

32. Any attempt at constructing new tanks must surely be premature in the present state of the sources of irrigation in the Warangal district; for, such an attempt pre-supposes that the existing arrangements are just as they ought to be. The fact is that, in this district, there are numberless tanks in a ruinous condition and large areas of culturable wet lands have therefore been lying fallow for want of proper irrigation. Hence, the first thing to be done is to restore these tanks to their proper condition, and then see if new ones are still required to make up the deficiency. The repairs of tanks may be carried on either directly by Government or by the *dastband* system described above; and since the latter system has been found to work well, all that remains to be done is to induce its circulation to the widest possible extent.

33. The accumulation of silt in tanks is no doubt a source of great inconvenience to irrigation, for, it gradually tends to reduce the depth and the capacity of the tanks. The average annual depth of silt accumulation varies according to the fall of the country and the nature of its soil, and hence it is that the deposit of silt in *regar* lands is nearly double and even treble, that in *chilka* lands. The quantity of silt deposited every year is estimated at 2 to 9 inches, and I know of no process by which this is being cleared up either year after year, or even once in many years. There is, however, one practical method by which the inconvenience or loss caused by silt accumulation is being obviated here—it is by raising the tank-bunds instead of resorting to the more expensive method of removing the silt. This has tended to raise the beds of tanks to a higher level and restore their capacity by raising their escape water-weir, and this process has also tended to bring the higher lands into cultivation.

E.—WELLS.

34. The district of Warangal is divided into ten talukas, and the average depth of permanent wells in each of them is as under.—

i.	Warangal	...	30 feet.
ii.	Wardanapet	...	25 „
iii.	Parkal	...	20 „
iv.	Mahbubabad		
v.	Khammamet		
vi.	Yellandapad		
vii.	Madhra		
viii.	Palwancha		
ix.	Warangal	...	15 „
x.	Pakhal		

(2) (*a*). In all the talukas generally, wells situated at a considerable distance from tanks are fed by springs, while those that are situated in rice fields under tanks are fed by percolation. In an ordinary year, there is an ample supply of water in both kinds of wells, and the crops raised under them seldom suffer for want of water.

(*b*) In a year of drought, the supply of water in wells greatly diminishes, and the area irrigated under them scarcely amounts to one-half of that irrigated in a year of ordinary rainfall.

(3) The average cost of construction of permanent wells in all the talukas is very nearly the same, and as pointed out by the rayats, it amounts to Rs. 250 to Rs.400 per well—the average well being taken as a well containing 2 *mots* and capable of irrigating 4 acres of rice lands. The cost increases with the provision for extra *mots*, and there are wells in the village Ghanpur of the Wardanapet taluka, of which some contain 6, and others as many as 10 *mots*, and the cost of which therefore amounts from Rs. 800 to Rs. 1,000 per well. But such wells are only very rare in the district, and even where they are, they belong to rich land-holders, Zamindars, Patels, Patwaris, etc. On the other hand, the cost of the wells situated in rice lands ranges from Rs. 15 to 50, and such wells exist in large numbers throughout the district.

(4) Permanent wells generally last from 30 to 40 years, while those situated in rice lands only last for a couple of years, nay, some of them are even renewed every year.

(5) Water from permanent wells is generally raised by means of *mots* and worked by bullocks in pairs, while water from the other small wells which contain no *mots* is generally raised by manual lifts called *yatams*.

(6) The area attached to each well depends on the number of *mots* with which it is provided, and such an area averages from 5 to 10 acres per well, one-half being utilised for the first crop, and the other half for the second crop. But where the water-supply in the well is abundant and the area attached to it is very limited, then the same land is utilized for both crops.

(7) The average area irrigated under a well in any one year amounts to 2·85 acres.

35. (1) It has been seen from actual crop experiments that lands cultivated exclusively under well irrigation generally yield twice as much as lands under tanks or any other direct flow. Hence, if two crops were raised under wells instead of one, the value of the produce will be more than twice as much as that of the produce from lands under tanks or other combined sources.

(2) No valuable crops, such as sugar-cane, betel-leaves, etc, are ever raised in this district exclusively under well irrigation.

(3) (*a*) The average commutation price of the yield from an acre of land irrigated under wells in a year of ample rainfall, as ascertained from actual crop experiments, is from Rs 62 to 78, and the yield from an acre of dry land is only from Rs. 6 to 10 as shown above. Hence, the increase due to irrigation is from Rs. 56 to 68 per acre.

(*b*) In a year of scanty rainfall, the average yield from an acre amounts to Rs. 37 to 52, and thus the increase due to irrigation ranges from Rs. 31 to 42.

(*c*) In a year of drought the average yield is from Rs. 22 to 35, which, when compared with the yield from an acre of dry land, gives an increase ranging from Rs. 16 to 25.

36 (1). The increase in the total annual value of the produce per acre, due to well irrigation, as actually worked out on the average of a normal term of five years, amounts to Rs. 42 *minus* Rs. 8, or Rs. 34.

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(2) In a year of drought, the above increase only amounts to Rs. 14 per acre.

37. (*Vide* answers to question 17 *supra*).—The well rates are levied neither on the area actually irrigated under a well, nor on the area commanded by it, but on the area fixed by Government, which is 2 acres per *mot*. For example, if there are 4 *mots* to a well, and the total irrigated land under it amounts to 10 acres or more, the cultivator has to pay the well rates only on 8 acres.

38. No difficulties of any kind are ordinarily experienced either in the selection of a suitable spot or in the actual construction of a well in this district. Nor is any assistance of Government applied for and obtained by the rayats in the construction of wells.

In very rare instances, the rayats, in the course of digging wells, come in contact with rocky beds which necessitate the seeking of expert advice or the resort to blasting.

39. I am not in favour of the construction by Government of wells in private lands, for, such a step, besides entailing a large amount of capital, will lead to manifold difficulties regarding the regulation of waters supply, the up-keep of the wells and the like; and after all, the return which the Government will get may not be in any way proportionate to the outlay of its labour and money. Here again I would draw attention to the suggestion submitted in answer to question 32 *supra*.

40. Temporary wells are largely resorted to in years of scanty rainfall and they actually afford considerable protection against drought. Since the existing rules regarding the sinking of wells are quite liberal and afford sufficient inducement to the rayats, I have nothing more to suggest than what has already been shown in my answer to question 4 *supra*. The number of temporary wells existing in the district at present is 7,807.

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1. Q. (*The President.*)—We are very much obliged to you for your paper. You have given us a number of interesting details of the country. In reply to question No. 3 you say that "the population increased at the rate of 26·25 per cent. during the decade ending 1891, while the rate of increase during the decade ending 1901 was only 11·67 per cent." Do you think that falling off from 26 to 11 was due to deaths during the famine?—There was no famine in this district in 1896-97, nor in 1899.

2. Q. (*Mr. Muir-Mackenzie.*)—Is it not possible that the enumeration in 1891 was rather imperfect?—We have nothing to do with the census department; we simply take its figures for granted.

3. Q. (*The President.*)—You are in the Hyderabad Division?—For the present; I was previously in Warangal and have just been transferred.

4. Q. Apparently there are ruins of tanks over the whole of the country?—Yes, there are many over the whole country.

5. Q. There is no question of making new tanks?—No, all that is required is to repair the old ones. The total number in Warangal is 3,970, out of which 1,129 are in a dilapidated condition and 2,841 are in good order. Similarly the number of wells is 27,000, of which 16,000 are in good order and about 11,000 are in a ruined condition. I have given some information about rice cultivating wells in my written answers.

6. Q. I suppose you know the whole of the Warangal district?—Yes, and I know Elgandal also.

7. Q. There is a project just now which is being considered in Madras to make a great dam over the Kistna opposite Warangal (position shown on map),—do you suppose if a canal could be got down from that it would do any good in Hyderabad?—No.

8. Q. Is the land too high?—Yes, and a portion in Nalgundah is entirely covered by forest. Besides, the population too is very scanty.

9. Q. Could a canal be of any use in Langugeri?—No, it is a British zamindari and has nothing to do with these Dominions.

10. Q. It would be a great advantage if it was possible to do something on both sides?—Yes, but the land is on a higher level this side.

11. Q. Have you got personal knowledge of the Tungabhadra and thereabouts?—I was an Assistant there and have some experience; there is a large anicut there from which the rice lands of His Highness' Dominions are irrigated. There is a scheme there which would be beneficial.

12. Q. It is under consideration just now?—Yes. It would benefit Lingupur which is the most famine stricken part of the country.

13. Q. So that if a scheme was devised by the British Government of making a great reservoir above Hospet, it is probable that it would be favourably received by His Highness?—Yes.

14. Q. I think it is most desirable that both should join as far as possible?—Yes I think so too, and the country is not on too high a level as is the case towards the Kistna.

15. Q. As regards these tanks that are repaired, do you find that the population there is sure to follow pretty quickly?—Yes. I have said in the 6th paragraph of my answers to printed questions "there is no fear of any extension of irrigation tending to injure the remaining cultivation by attracting its cultivators to the irrigated tracts. There is an ample supply of agricultural cattle in the district, there is a large quantity of manure available, and the chief occupation of the people is agriculture, and hence the rayats of this district always want more land for cultivation, and there is therefore no fear of their relinquishing their present holdings and taking to the cultivation of newly-irrigated lands." I have seen the Ghanapur tank, there was not an inch of cultivation under that tank for the last 20 years, and as soon as the repairs were taken in hand, the people came rushing in with their applications for land. The climate is unhealthy and still the people come and take lands.

16. Q. From far?—Yes, from the adjoining villages, and from far.

17. Q. And they clear the jungles?—Yes. I have said something about agricultural tanks in my answers to printed questions; it is the "burning" question of the day.

18. Q. You say in reply to question No. 13 (2) "the valuable crops such as sugar-cane, etc., could not be raised under those canals the supply of which is uncertain." Do they not employ supplementary wells?—No; under canals of intermittent flow they only raise one crop of rice.

19. Q. How long do they flow?—Four months. I think for the winter crops the water is sufficient.

20. Q. Do they not supplement it by wells?—No.

21. Q. Why; they seem to be great hands at cultivation. I was much struck with the quantity of irrigation by wells?—That is all for rice.

22 Q. I have never seen rice cultivation by wells before. Why don't they do sugar-cane in the same way?—They would have to lay out a large amount of capital which they lack. In Mehdak there is sugar-cane cultivation under tanks.

23. Q. Do tanks last long?—They last for 18 months (3 *fasls*). There is also the Pakhal tank in the Warangal district which never dries up. I have referred to it in my reply to question No. 6.

24. Q. Is there any taluka or any portion of His Highness' Dominions which is so well irrigated as to be quite safe from famine?—No There are parts where famine is unknown owing to rainfall and irrigation. In Tolingana there are a number of wells, and in Warangal there are 27,000 of them.

25. Q. For wells that the rayat makes, has he to go to the Sowcar?—Yes.

26. Q. He cannot get anything from Government?—No. These wells are situated in the rice ayacut and cost very little, say from Rs. 15 to Rs. 20.

27. Q. Are there *kachcha* wells?—Yes.

(*Mr. Muir-Mackenzie.*)—Are these 27,000 *pakka* or *kachcha*?—Some of them are *pakka*, and the rest *kachcha*.

28. Q. What proportion are *kachcha*?—I have said somewhere there are 7,000 *kachcha* wells. Wells situated in the ayacut are mostly *kachcha*.

29. Q. You say in reply to question No. 24 "there are already 93,689 acres of single rice crop lands under tanks," that is in one district?—Yes.

30. Q. What is the whole dry and wet cultivable area?—The figures are given in Mr. Allen's report at page 10.

31. Q. Supposing you had to choose between giving a small area of land under two crops and a large area under one crop, which would be better for the country?—When there is a small piece, the people work hard and try as much as possible to raise two crops there. In Warangal the average area of a holding is 2 or 2½ acres, and the average

yield is only one candy, whereas in Medak it is ½ to 1 acre and the yield is two candies.

32. *Q.* For the good of the country, supposing you had famine coming on, would it be better to devote one's attention to getting a single crop over a large area or a double crop on a small area?—I think a single crop over a large area is better.

33. *Q.* Are you satisfied with the *dastband* system?—Yes, that was proposed by Mr. Dunlop and is working very well.

34. *Q.* It gives up one-tenth of the revenue to be spent on repairs?—Yes.

35. *Q.* After a certain time it should not cost one-tenth?—A man has to look after the tank always.

36. *Q.* Does any body come and inspect it?—Yes, we have Revenue Inspectors.

37. *Q.* Do the Public Works Officers do it?—Not Public Works Department Officers but Irrigation Officers.

38. *Q.* (*Mr. Higham.*)—There are tanks in Warangal, do they cultivate nothing but rice?—No.

39. *Q.* Have they any semi-wet crops?—No.

40. *Q.* They very seldom have enough water to bring rice to maturity?—They are supplemented by wells in Warangal.

41. *Q.* They never attempt to irrigate dry crops?—Never under tanks.

42. *Q.* Why is that?—They are not accustomed to raise dry crops under tanks; sometimes they do it under wells, as fodder for cattle.

43. *Q.* I suppose if they raised dry crops, they would do better?—They would have to prepare the lands for cultivation, and that is very expensive.

44. *Q.* When a tank is opened for the first time they have to break up their lands?—In such cases they do.

45. *Q.* Have they enough rain for dry crops?—Yes.

46. *Q.* That is *cholum* and *juari*?—*Juari, tilseed* and castor seed are the staple crops.

47. *Q.* I suppose *juari* fails in a very dry year?—Most of the land on which it is grown is *chilka* or sandy loam which does not require much water.

48. *Q.* Do they ever get famine in Warangal?—They have not had it for the last 12 years.

49. *Q.* (*The President.*)—Was there famine there in 1877?—There was famine in the Mahratwara district, it didn't come here. The Telingana district is very safe.

50. *Q.* (*Mr. Higham.*)—I suppose dry cultivation does not fail?—No.

51. *Q.* Has the *dastband* system of repairing tanks been generally adopted?—Yes.

52. *Q.* You pay a man for doing repairs?—Yes.

53 *Q.* How do you know that he has done them?—We have Revenue Inspectors to supervise and report if the work has been done.

54. *Q.* Are the people supposed to do repairs annually or when necessary?—When necessary.

55. *Q.* Are they not apt to let a tank fall into a bad state of repair?—No, they are careful enough, because they know they will have to spend more money afterwards.

56. *Q.* Do they have to get a certificate?—Yes, unless they get a certificate from the Irrigation Department, they are not paid.

57. *Q.* (*Mr. Muir-Mackenzie.*)—Is that every year?—Yes.

58. *Q.* (*Mr Higham.*)—Supposing you give an Inam dar land?—We don't give lands now, only ¼th of the revenue.

59. *Q.* Do you give a permanent reduction in the assessment of the land?—We don't give that now, we always pay in cash.

60. *Q.* How do you ensure that you get full value for whatever concession you give them?—We can satisfy ourselves whether they have got a tank in good order and what they have spent.

61. *Q.* What do you give for annual repairs?—Ten per cent. of the revenue.

62. *Q.* It is not given until they have got a certificate?—No.

63. *Q.* Ten per cent. of the revenue is allowed to pay for ordinary repairs?—For small tanks we don't do it; it is only for large tanks, those that are under the supervision of the Public Work Department. Very few tanks have been let to zamindars, more are under Government.

64. *Q.* (*Mr. Muir-Mackenzie.*)—In a year of very great drought supposing you had only 7 to 8 inches of rain, would all these tanks dry up?—Yes, they are sure to.

65. *Q.* Even with such a small rainfall as that, would you have plenty of dry cultivation?—Yes.

66. *Q.* Do you consider you could always rely on considerably larger rainfall than that?—Yes.

67. *Q.* Even when you have famine in other parts of India?—Yes.

68. *Q.* The Ghanapur tank was breached 20 years ago?—Yes.

69. *Q.* And the people deserted?—Yes.

70. *Q.* And did that happen in many other places?—There is a large tank in Pakhal, and most of the people there deserted.

71. *Q.* Was it on account of the breach in the tanks?—*I think so.*

72. *Q.* Do you think the census figures are trustworthy, sometimes they vary very much. I want to know how much we can rely upon them and whether they are better now than they used to be. Can you give an opinion?—We will have to rely upon these figures.

73. *Q.* Do you think they are reliable?—Yes, I think they are reliable.

74. *Q.* I understand that if you put a tank into repair, although the population is sparse, the people come in at once?—Yes.

75. *Q.* In some of the talukas there is a considerable percentage of *regar* soil?—Yes.

76. *Q.* Is that soil irrigated?—Some is.

77. *Q.* The fact of its being *regar* makes no difference—No.

78. *Q.* Is it different from the *regar* soil of Mahratwara?—Yes, there is a large quantity of soda in Telingana *regar.*

79. *Q.* Is cotton grown in *regar* soil?—Yes, but it is only half the produce compared with Mahratwara.

80. *Q.* What is the assessment on lands under wells, is it just as high as lands under tanks?—No. On lands under tanks it is half the net value or quarter of the gross value; for wells it is half that again.

81. *Q.* How do they compare with dry crop?—I have shown it in my answers to printed questions.

82. *Q.* What is the rate of assessment?—In Warangal the average rate is Rs. 10-4 on everything.

83. *Q.* I want to know on well lands?—In Chirial taluka there is a good deal of well irrigation, and the rates under wells were very high when I took up the taluka for settlement. There we have fixed our average rate for rice lands under direct flow at Rs. 14 per acre and that under wells at Rs. 10 to Rs. 11. Gardens are assessed at Rs. 4.

84. *Q.* What is the dry rate?—Rs. 1-8 to Rs. 2 per acre.

85. *Q.* Under your well rules a man does not pay rates for 15 years?—No, he pays dry rates for the first 15 years, and then he pays double the said rates for the next 15 years, and then the ordinary well rates.

86. *Q.* Are rates on that scale likely to encourage the extension of wells?—No, I don't think so.

87. *Q.* What way is there of encouraging it?—There is no necessity to pay double the dry rates for the second 15 years.

88. *Q.* (*The President.*)—We passed a great deal of well irrigation on our way from Bezvada, rice was grown there. Were most of the wells in the ayacut?—This is not the season, in summer only they use wells.

89. *Q.* They were working. As regards rice lands irrigated by wells, are the lands in the ayacut of tanks?—Most of them are.

90. *Q.* Why do you take more for rice than for garden crops?—The outturn is very great; garden cultivation does not pay much, there being only chillies.

91. *Q.* (*Mr. Rajaratna Mdlr.*)—Is turmeric grown under wells?—Very little; we charge garden rates for that.

92. *Q.* In the case of ayacut wells, do the cultivators use also tank water?—Yes, until they get tank water they will never trust to wells.

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93. Q. (*Mr. Muir-Mackenzie.*)—What is *abi*?—Winter crop, *tabi* is the summer crop; the produce of *tabi* is generally one and-a-half times that of *abi*.

94. Q. As regards the tanks that have been put into repair, how do you propose to keep them up?—Government should do it.

95. Q. Cannot the villagers do it?—We have been trying to make them, we pay 10 per cent.

96. Q. For what is that 10 per cent. given?—For maintenance only. For breached tanks they are paid from revenue.

97. Q. (*Mr. Rajaratna Mdlr.*)—Supposing a tank breaches after the *dastband* system is introduced ultimately, they will be bound to close the breach?—Yes.

98. Q. (*The President.*)—Do you think the 10 per cent. system is a good one?—Yes, I am in favour of it. Of most of the tanks that have been let out the area is more than 50 acres.

99. Q. Who is to see that the *dastbandar* does his work?—The Irrigation Inspector.

100. Q. How long do wells last?—A permanent well will last 30 or 40 years without repairs.

101. Q. Given ordinary repairs, is there any reason why they should not last for ever?—In Warangal they were not properly kept up; most of the wells I have seen do not last longer than 30 or 40 years.

102. Q. If they were properly kept up?—They would last for generations.

103. Q. (*Mr. Muir-Mackenzie.*)—Were not considerable advances given in connection with wells?—Only in the Mahratwara country.

104 Q. How were advances regulated, by executive order?—Yes; they will be recovered by instalments.

105. Q. They do not require a special law here to enable them to do that. There is no reason why you should have a law?—No.

106. Q. If plenty of money were provided, would the people take it up?—Yes, I think so.

107. Q. Mr. Dunlop expresses some doubt about that. He said people were not fond of taking loans?—If they are made to understand the conditions they will take them up. The rate of interest paid to the Sowcar is very high.

108. Q. Do you think they will take up loans from Government?—If the matter is properly explained and orders circulated they will.

109. Q. As regards ayacut wells, what are the rates charged?—We have got half the rate.

110. Q. That allows for lift?—Rupees 12 is the average wet rate charged for Chirnal taluka, so the average on wells in the ayacut will be Rs. 6.

111. Q. (*Mr. Rajaratna Mdlr.*)—In Warangal district you said 10,756 wells were out of repair?—Yes, in the whole of the district.

112. Q. Is anything being done to enable the rayats to restore these wells?—Yes; the wells are being given out.

113. Q. You say in paragraph 17 (2) "the district of Warangal has been regularly settled and the settlement rates have been guaranteed for a period of 15 years, and hence the Government (the ultimate owner of lands) cannot claim any enhancement of rent due to irrigational improvements carried on during the continuance of the said guarantee." If special improvements are carried out during the currency of the settlement, is there any right to enhance the assessment?—Yes, I have said further on: "The Government, of course, reserves to itself the right of claiming an extra benefit for its own works, that is, if dry lands are converted into wet, or single crop rice lands into double crop lands owing to the improvements introduced by Government, then the lands are assessed then and there according to their improved quality. In no case, however, can the maximum rates once guaranteed be enhanced before the expiry of the period of guarantee." We have a fixed rate of Rs. 16 for rice lands, that has been sanctioned by Government, and we cannot increase the rate beyond that during the term of settlement.

114. Q. Supposing you turn a river channel into a tank and improve the supply, can you, during the currency of the settlement, raise the assessment?—No.

115. Q. But you claim extra benefit for your own works?—If land is converted into wet we will charge wet rates up to Rs. 16.

116. Q. Supposing under a tank the supply is precarious, do you take that into account?—We give them a remission if the supply fails.

117. Q. Your rates will be lowered then under a channel?—For tanks we have one rate, for channels separate and for wells separate.

118. Q. I suppose your rates vary under different tanks?—No, we have one set of rates for all tanks.

119. Q. You don't group your irrigation works?—There are large and minor tanks. Large tanks are 1st class, and minor tanks, 2nd class.

120 Q. Supposing a minor tank is improved and converted into 1st class, do you increase the rates?—We never do so during the currency of the settlement.

121. Q. You say in paragraph 32 "the fact is that in this district, there are numberless tanks in a ruinous condition and large areas of culturable wet lands have therefore been lying fallow for want of proper irrigation. I suppose steps have been taken to restore these tanks?—This is going on under the *dastband* system.

122 Q. (*Mr. Muir-Mackenzie.*)—The tanks are being restored under the *dastband* system?—There are two systems; for maintaining them there is the 10 per cent., and for restoring them the *dastband*, system.

FORTY-NINTH DAY.

Aurangabad, 26th February 1902.

WITNESS No. 46.—NAWAB BASHEB NAWAZ JUNG BAHADUR, Subadar of Aurangabad Division.

Nawab Nawaz Jung.

26 Feb. 02.

1. Q. (*The President.*)—Is there any scope for increase of tank irrigation in Mahratwara?—Yes, the first thing to do is to repair the old tanks; there are some old tanks that should be repaired. There are some old tanks, but not as many as in Telingana. In the taluka of Kamar in this district there are nallahs from which irrigation is carried on. This could be extended.

2 Q. You think it would be a good thing to encourage extension?—There must first be a survey to ascertain whether there are suitable places, after the survey it may be possible for Government to improve the irrigation resources. In Chikletana there is a nallah from which some irrigation is carried on. In the district of Parbani in the Jelin taluka in the village of Bogaon there is a tank from which 100 to 150 acres can be cultivated.

3. Q. Were the tanks here in old days—in Aurangzeb's time?—Yes; near Daulatabad 10 or 12 tanks were made in his time; there is no cultivation from them now, except from one tank from which vines are watered.

4. Q. Is there any rice cultivation here?—Very little.

5. Q. What is the staple food?—*Juari* and *bajra*.

6. Q. In famine time how were the people employed?—On roads and railways, and few tanks were repaired; it is all given in Mr. Dunlop's reports.

7. Q. Do you keep up any programmes of famine works? (*Mr. Dunlop*) There is no programme ready. We wish to have them. We are anxious to have a survey by the Irrigation Department. *Witness.* There is no programme ready.

8. *Q.* Should such not be kept up?—It would be a good thing to have them.

9. *Q.* As regards wells, there are 9,000 irrigation wells in the Aurangabad district, are any new wells being made?—Yes.

10. *Q.* One-and-a-half lakhs of *takavi* was given; was this for wells?—In the famine year 1,310, three lakhs was given in this division, both for the sinking of new wells and for repairing old wells.

11. *Q.* Is *takavi* taken freely?—Yes, because it costs less than borrowing from the sowcar. Six per cent. is charged.

12. *Q.* Has much been done through *takavi*?—Yes, it helped the rayats who probably spent 3 or 4 annas out of each rupee on their own subsistence or on the purchase of cattle.

13. *Q.* In your opinion if tanks are made, how can they best be kept in repair? Could the *dastband* system be established here?—No, the *dastband* system would not suit the Mahratwara, where the people are not accustomed to irrigation as in the Telingana; it might be introduced by degrees.

14. *Q.* (*Mr. Muir-Mackenzie.*)—If the *dastband* system were introduced, what people would be available as *dastbandars*? Are there any Deshmukhis and Deshpandes left?—There are, but they have not the means. The watandars won't do it. Perhaps the sowcars would undertake it.

15. *Q.* Couldn't the watandars carry out repairs costing less than Rs. 500?—They might take to it after some years, but there has never been any *dastband* system in the Mahratwara?

16. *Q.* In which districts are there most irrigation wells?—There is no village without its 10 or 20 wells, either *pakka* or *kachcha*, mostly *kachcha*. In my opinion the thing to do is to increase the wells in Mahratwara.

17. *Q.* How would it be done?—By giving advances for repairs or making wells.

18. *Q.* (*The President.*)—How many years are allowed for the recovery of *takavi*?—

19. *Q.* (*Mr. Dunlop.*) Three or four years. It is proposed to make it ten years.

20. *Q.* (*Mr. Muir-Mackenzie.*)—Do you think ten years is quite enough?—(*Witness.*)—When they agreed to three years in the famine, the people were badly off. They could get no money from the sowcars and were obliged to accept the Government terms, but they cannot repay in time.

21. *Q.* Compared with the terms offered by the sowcar, do you think ten years sufficient?—Yes, provided the rayat spends the money on the works for which it is given.

Nawab Nawaz Jung.

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22. *Q.* (*The President.*)—Is *takavi* always repaid?—Yes, the instalments due have been generally collected; if the rayats did not keep faith with the Government, their fields would be attached.

23 *Q.* (*Mr. Muir-Mackenzie.*)—What happens if the fields are previously mortgaged?—The Tahsildar before giving *takavi* makes enquiries to ascertain if land is mortgaged.

24. *Q.* Is not much of the land mortgaged?—Yes.

25. *Q.* Then *takavi* can only be given to a few and to those who are best off?—No, it is also given to the poor.

26. *Q.* Will the sowcar's claim be allowed precedence to that of Government?—The Tahsildar would probably find means of recovering the money.

27. *Q.* Then why not give preference to the poorer rayat?—We do our utmost to give advances to the poorer rayats. There are many of those whose fields are not mortgaged.

28. *Q.* There is a great deal of black soil in this division?—Yes.

29. *Q.* Is it irrigated freely?—Not like soil in Telingana, but under wells they do irrigate wheat, rice, sugarcane, and garden-crops.

30. *Q.* Are there as many wells for irrigation in black soil as in red?—There are wells in both kinds of soils.

31. *Q.* What is the average cost of a well of one *mot*?—It depends on the soil, in soft soil it costs less.

32. *Q.* In black-soil?—Rs. 600 or Rs. 700.

33. *Q.* In *muram*?—The cost would be more.

34. *Q.* In Aurangabad Rs. 1,54,000 *takavi* was given for wells?—Some of the money was spent on merely repairing wells.

35. *Q.* Was a man ever given more than Rs. 500?—One or two.

36. *Q.* And more than Rs. 400?—Most of the people were given Rs. 400 or Rs. 500.

37. *Q.* Then very few people got the full price of a well?—In some places a well cost only Rs. 300.

38. *Q.* Are there many such places?—Yes.

Witness added:—

"I should like to say that it is more desirable to spend money on wells in Mahratwara than on tanks. They cost less, and you could have a *baoli* in every holding."

Witness No. 47.—Sayad Mohomed Belgrami, 1st Talukdar of Aurangabad District.

Memo. by Witness.

The Board of Revenue in their letter No. 1 (Irrigation Committee), dated 10th Sherwar 1310 F., called for information regarding the irrigation capacities of the district under the following heads:—

I. Repairs to existing tanks or other irrigation works.

II. The extension and improvement of existing irrigation works.

III. Suggestions as regards irrigation projects by utilising rivers, streams, etc.

IV. Construction of reservoirs for collecting water of natural springs for drinking and irrigation purposes.

V. Extension of irrigation by means of wells.

A circular was issued to the Tahsildars of different talukas, and the replies received from them are herein summarised under the above five heads.

I. Repairs to existing tanks or other irrigation works.

Bijapur.—In this taluk there are two tanks, one in the village of Bhalgaum and one in Naligaum. The Bhalgaum tank is almost level with the ground and scarcely admits of repair. The tank at Naligaum can, however, be repaired and will irrigate nearly 2,000 acres of land. The estimate for these repairs is Rs. 60,000 and the estimated revenue per annum Rs. 6,000.

At the head-quarters of the taluk Bijapur is an old dam entirely out of repair.

Kannad.—At Kannad, the head-quarters of the taluk, there is an old dam across the Sibna river, and the rayats repair it annually with mud and obtain a certain amount of water. A sum of Rs. 1,038 has been sanctioned for repairs to this dam. But the amount is insufficient and a further sum of Rs. 2,000 is required. The estimated revenue after repair is Rs. 2,000.

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There is also a dam across the Purna at the village of Nagapur. The repairs to which are estimated to cost Rs. 5,000, the annual return being only Rs. 500. There is also an old dam at the village of Bamni in this taluk. But the cost of the repairs is estimated at Rs. 8,000, the annual return being only Rs. 500.

Jalna.—There is a small tank at the village of Kajjla. This tank is susceptible of enlargement as the catchment area is large. When enlarged, it will irrigate the lands under three or four villages. The estimated cost is Rs. 15,000 and the annual return Rs. 2,000.

The tank at Jalna after necessary repairs might be made to irrigate a few acres of land.

Ambad.—There is a large tank at Ambad. The repairs to which are estimated to cost Rs. 50,000. It will, however, irrigate 1,000 acres of land, and the yield will be considerable. The tanks at Jamkheid, Chichkheid and Dhakaphal are all out of repair. The estimate for each of these tanks is Rs. 12,000, the land brought under wet cultivation being 600 acres at Jamkheid and 300 acres each at Chichkheid and Dhakaphal. These villages being surrounded by hills, the tanks are susceptible of considerable enlargement and improvement.

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Khuldabad.—In the village of Anjandho there is an old tank of the time of the Emperor Aurangzib, the repairs to which are estimated to cost Rs. 8,000. It will irrigate about 100 acres of bagath land, the yield from which will be Rs. 900.

Sillur.—At Sillur there is an old tank entirely out of repair, the restoration of which will be so costly that no return can be expected.

Aurangabad.—The repairs to the large tank at Elura are estimated to cost Rs. 22,000, the cultivable area being 500 acres and the estimated revenue Rs. 5,000.

II. The extension and improvement of existing irrigation works.

The district of Aurangabad being entirely a Mahratwari district devoid of any large irrigation works, no extension or improvement can be suggested. A few suggestions, however, have been offered under question III.

III. Suggestions as regards irrigation projects by utilising rivers, streams, etc.

The only river of any importance passing through the district is the Godaveri, and with a proper survey by a competent staff of Engineers, it may be possible to find places where the water may be utilised for irrigation purposes. But such projects require not only time to mature them, but also large outlay to carry them out. In all projects connected with the Godaveri, the fact to be remembered is that in several of the talukas this river marks the boundary between British territory and the territories of His Highness, and in selecting sites for irrigation works only those points must be chosen where the land on both banks of the river is in His Highness' territory. But on the whole the expenditure of capital on irrigation works in the Telingana districts is so highly remunerative that I cannot recommend even a survey of Godaveri projects in this district.

IV. Construction of reservoirs for collecting water of natural springs for drinking and irrigation purposes.

In regard to this question, the answer from all the Tahsildars is that there are in this district no such natural springs as can be utilised for the purposes of storage of water. Considering the nature of the country and the fact that the subsoil water is so low, this reply is not to be wondered at.

V. Extension of irrigation by means of wells.

Two statements (A and B) are herewith submitted, giving full details regarding the wells in the different talukas. Statement A gives the number of villages in each taluk, the number of irrigation wells, the number of other wells and the total. Statement B shows the distribution of the takavi grant made last year, and it will be seen that the amount of the grant absorbed by the different talukas is in proportion to the extent of the drought from which they suffered.

The total number of wells in this district as shown in statement A is 12,744, giving an average of 3·4 per square mile of cultivable area excluding *jagir* lands, so that there is great room for improvement in this direction. At the same time it has been proved by experience that these wells do not afford sufficient protection from famine. The majority of them dry up entirely. I am, however, of opinion that full encouragement should be afforded to the rayats for digging fresh wells and improving the existing ones. The extent to which the takavi grant has been availed of shows that the rayats are ready to accept Government aid for this object

STATEMENT A.

Name of Taluka.	Number of Villages.	Number of Irrigation Wells.	Number of other Wells.	Total.	Remarks.
Aurangabad .	204	1,504	556	2,060	
Ambad . .	221	1,533	614	2,147	
Gangapur . .	210	804	199	1,003	
Pattan . .	142	525	225	750	
Bijapur . .	116	1,160	401	1,564	
Jalnapur . .	167	1,241	632	1,873	
Kannad . .	196	858	365	1,223	
Bhokurdun . .	149	857	313	1,170	
Khuldabad . .	34	175	72	247	
Sillur . .	52	551	156	707	
TOTAL .	1,491	9,208	3,536	12,744	

STATEMENT B.

Name of Taluk.	Number of wells for which takavi was given.	Amount of takavi.	Remarks.
		Rs.	
Aurangabad .	2	350	
Ambad . .	3	600	
Gangapur . .	325	51,699	
Pattan . .	5	1,000	
Bijapur . .	212	50,400	
Jalnapur . .	46	9,275	
Kannad . .	...	...	
Bhokurdun . .	194	41,015	
Khuldabad . .	...	...	
Sillur . .	...	...	
TOTAL .	787	1,54,339	

1. *Q.* (*The President.*)—You are first Talukdar of Aurangabad?—Yes.

2. *Q.* How long have you been there?—One year. I was not here during the famine.

3. *Q.* (*Mr. Muir-Mackenzie.*)—Were you in Mahratwara?—I was in Bidar.

4. *Q.* The famine was very bad in Bidar?—Yes, but not so bad as in Aurangabad; three talukas were badly affected.

5. *Q.* (*The President.*)—Do you think there were at any time many tanks in Mahratwara?—No.

6. *Q.* Are there any traces of former tanks?—Yes, but they are quite level.

7. *Q.* Were there many?—More than at present.

8. *Q.* Was it enough to depend upon, was it like Telingana?—No, the Mahratwara country is dry-crop producing, they don't require so much irrigation as in Telingana where produce is paddy.

9. *Q.* Is wheat grown here?—Yes, wheat, gram and juari; both hot and cold weather juari.

10. *Q.* Do you think the existence of black cotton soil is a reason why there is less irrigation than otherwise?—The crops don't require irrigation in black soil so much as in red.

11. *Q.* What is the best protective measure to take for this part of Mahratwara in order to protect it against famine?—I think the rayats should be encouraged to sink wells and Government should help them to do so.

12. *Q.* Could they go on putting wells in every acre of land, would not the wells rob each other?—That depends on the area of the holding.

13. *Q.* How near could wells be put together; could they be put 100 yards apart?—Yes.

14. *Q.* Fifty yards apart?—I think 100 yards would be best; besides, water is not available everywhere.

15. *Q.* There is another thing. If you increase the number of wells, supposing you had ten times the number of wells you have at present, where are the cattle to work them?—That is no doubt a question. It is only well-to-do farmers who would require more than one well.

16. *Q.* What area of the country could you irrigate by wells, could you irrigate one-tenth of the culturable land?—Hardly.

17. *Q.* Could you irrigate one-twentieth?—Perhaps so. I think not more than 3 per cent.

18. *Q.* (*Mr. Muir-Mackenzie.*)—There is now more than 3 per cent. under irrigation, and almost the whole of that is under wells. Do you think that cannot be increased at all?—It is possible to do it.

19. *Q.* Do you think you might double it?—It depends on the outlay of money.

20. *Q.* (*The President.*)—Supposing His Highness was willing to give takavi advances?—I think the people would come forward because a great many are anxious to have wells. Even supposing there is no famine they can always raise garden crops and that is more paying than grain.

21. *Q.* You say in your memorandum "full encouragement should be afforded to the rayats for digging fresh wells and

improving the existing ones." What encouragement would you give more than there is now?—More takavi.

22. *Q.* Do you give a certain amount?—No, there are three talukas which had suffered in 1309 and could not recover in 1310; Vizapur, Bhokardan and Gangapur, the Subadar applied for takavi and it was given.

23. *Q.* It is not given every year?—No, this year for the first time to my knowledge takavi was given for sinking wells.

24. *Q.* Do you think it would be a proper policy to give it every year?—Yes.

25. *Q.* Until there are a number of wells?—Yes, I think it is worth trying.

26. *Q.* You probably heard the Subadar giving evidence; in how many years should the loan be recovered? Do you think ten years would be quite long enough?—Yes.

27. *Q.* (*Mr. Higham.*)—What is the rate of interest?—Six per cent.

28. *Q.* Did the level of the water in the wells fall very much during the last famine?—Yes, very much, in fact in a great many wells there was no water at all. The subsoil water is so low that very few wells can stand the strain.

29. *Q.* (*The President.*)—How low is the sub-soil water in general?—Fifty feet in some places, in others 40 feet.

30. *Q.* (*Mr. Muir-Mackenzie.*)—Is it found so low as 50 feet?—Sometimes.

31. *Q.* In the villages near the river?—No.

32. *Q.* (*Mr. Higham.*)—Did they make any effort to deepen a well?—Yes.

33. *Q.* Did they get any water when they did?—Yes.

34. *Q.* Is it the subsoil rock?—Sometimes it is.

35. *Q.* Do they have to blast?—Yes.

36. *Q. Can they do it themselves?—There are people* who do it.

37. *Q.* In the famine year did the area cultivated by wells fall off very much?—Yes.

38. *Q.* How much?—I was not in this district. I think it almost totally failed. It was an exceptionally dry year, there was hardly any water even for drinking purposes.

39. *Q.* Did you give remission of revenue when the wells failed?—Not in Mahratwara; this is a settled district and we don't give remissions; in a famine year we suspend and recover the amount gradually.

40. *Q.* Can you say what was the area actually cropped?—No.

Syad Mohomed Belgrami.

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41. *Q.* (*Mr. Muir-Mackenzie.*)—The assessment on land upon which a new well is made is not enhanced in the Mahratwara?—No, not if the well is made by a rayat, until the revision of the settlement.

42. *Q.* Would the land under that well have a higher rate than the dry rate at the revision?—It ought to.

43. *Q.* What are the orders on the subject?—The orders are that only on lands that are improved *at Government expence should higher* assessments be taken. But on lands improved by the rayat at his own expense the rent is not enhanced until the revision of the settlement.

44. *Q.* Do the rayats understand that?—I think they do.

45. *Q.* How long ago was that order passed?—About fifteen years ago in all the settled districts in the Mahratwara.

46. *Q.* Has the effect of that order been to increase the number of wells in the district?—I don't think so. As a rule the rayats are not rich enough to make wells or anything of the kind as a means of irrigation. I was at Bhokardan in the year following the famine and distributed takavi for wells in that taluka. I should say that when people come to know that the terms are favourable they come forward freely for takavi.

47. *Q.* You have no money this year?—No.

48. *Q.* Supposing on the Godaveri a site for a dam was found and a canal brought water into the Aurangabad district, would the people take water do you think, in an ordinary year, or would they say that their crops were quite good enough?—It would not be so advantageous as in *Telingana.*

49. *Q.* Would the people in Aurangabad take the water?—*I think they would. It would* produce sugarcane and other crops that require water.

50. *Q. Between Aurangabad and the river Godaveri is it* not black cotton soil?—Yes.

51. *Q.* Would the people take canal water if it was brought to that land, when the rainfall is good?—In a good year they don't require water.

52. *Q.* In the country between the railway and the river are wells numerous?—No, I have seen many villages bordering the Godaveri and then I should say there were very few wells, because the soil is very rich, and being on the banks of the river if any water is required they utilize the water of the river.

FIFTIETH DAY.

Amraoti, 28th February 1902.

WITNESS No. 48.—Captain D. O. MORRIS, Deputy Commissioner, Amraoti.

Cap. D. O. Morris.

3 Mar. 02.

Answers to printed Questions.

1. On general questions I can speak of the whole Province as I have camped over nearly the whole of it. Statistics that I give unless otherwise specified refer to the Wun district only.

2. *Rainfall.*

Normal of 10 years—

April.	October.
May.	November.
June.	December.
July.	January.
August.	February.
September.	March.

Famine year 1899-1900.

April	1899	October	1899
May	,,	November	,,
June	,,	December	,,
July	,,	January	1900
August	,,	February	,,
September	,,	March	,,

3. (1) No.

(2) No.

(3) No.

(4) No.

(5) A certain amount as regards wells and tanks.

(6) There is lack of capital for initial expenditure

(7) Not now very much.

(8) No.

(9) No.

4. There is an exemption in the fact that our Revision is for 30 years and improvements made are not subject to enhanced revenue until a new revision. Moreover under section 44 of the Berar Land Revenue Code the improvements made by digging wells cannot be a cause for increase of assessment. But it is specially provided that this section does not affect the provisions of section 11 of Act XIX of 1883 (Land Improvement Loans Act) which allows the Local Government with the approval of the Governor General in Council, to make rules, fixing a period after which land, which has by the introduction of irrigation been turned into irrigated land, may be assessed at irrigated rates. I am not aware that any such rules have been framed.

In practice the exemption is fully secured. The land revenue once fixed is sanctioned by the Resident and cannot be altered. Increase of revenue may be progressive, but if

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so, the rate is fully laid down for the whole period of the tenure.

5. Loans are not taken at all freely because the cost or making a well is high and the uncertainty of finding water is great. The only remedy that I can suggest is the sinking of trial wells in various places. When the people see that water can be got they will be more inclined to take loans, if the terms are made easier as suggested below. I would recommend—

(1) redr otion of interest to 3 per cent;

(2) rem ssion of interest in first two years while well is being made;

(3) not remission of advance but deferring of payment of it until the well has been sunk. This would make the first payment payable two or three years from date instead of one.

(4) total remission in cases of failure to get water.

(5) grants-in-aid up to half the total cost in picked cases.

I would not recommend—

Extension of period of repayment except as noted above in (3).

6. No.

No. There is a great desire in all places to construct wells provided there is a reasonable chance of getting water.

7.—22. Do not apply to Berar.

Q. 34.—

1. Wells vary as follows—

In hilly tracts—

	feet.
Black Cotton soil	
Soft Muram	3—4
Hard "	3—4
Soft stone	5—6
Black rock	6—30
	4—150
	21—194

In low tracts—

	feet.
Black Cotton soil	
Soft Muram	4—15
Hard "	6—7
Soft stone	10—12
Black rock	6—10
	4—30
	30—74

2. Percolation as a rule very occasionally springs or subterranean pans are lapped.

3. Cost—

(1) up to 30 feet depth—

	Rs.
In stone masonry	300—400
In brick "	275—350

(2) From 30—40 feet depth"—

Stone	350—500
Brick	325—450

Above this depth I do not think statistics can be given, but the cost of masonry would not be much more, and the cost of boring would depend on the labour employed, hardness of rock, etc.

4. A well lasts without repairs—

	years.
Brick	6—7
Stone	10—12

If the question means duration of water it varies—a good well does not dry at all. A poor one will dry in March or April.

5. Water is invariably raised by mot, *i.e.*, bullocks and water bag, except in the rivers where it is done by counterpois.

Q. 35—

1. Irrigation allows of two crops as follows:—

1st crop. Urid, Mong, Til or Bajri.

2nd crop. Gram, wheat, garden crops, including fruit trees.

This double crop is possible without irrigation if the winter rains are exceptional but irrigation secures it. It is common in Buldana district. Only 99 acres in Wun and that in Mukatband Tank.

2. Practically the only special crop is sugarcane. It is valuable but not so much so as the people do not know how to make goor.

3. Irrigation is of no value in increasing the yield of zerait crops at all, but it allows crops to be grown in years of scanty rainfall that otherwise could not be grown.

36.

37. Baghait rates are now fixed at the highest rates of zerait in the group. They are paid on the amounts under baghait at the time of survey.

38. This is the main difficulty in the question of sinking wells. Once assured that water can be reached at a reasonable distance many people will make wells.

No assistance has, I believe, ever been offered by any one A trial well has been sunk at Akola which is, I believe, 200 feet deep. The only possible assistance is, as I suggested before, trial wells. This could even take in some cases the form of artesian wells.

39. I see no objection to the scheme. The owner of the property would be only too willing. The main difficulty is funds. I can state that field owners would be willing to accept either of the following conditions:—

(1) If water is reached to continue the work and build up the well reimbursing Government the amount spent.

(2) For Government to finish the well and make it over to the field owner who would reimburse the amount spent by yearly instalments in the same way as a takavi loan.

Before commencing the work a bond could be taken from the owner by which he undertook in the case of water being found to accept one or other of these ways of repaying the money. If water was not found the bond would be cancelled.

40. Not in the Wun district. In the Buldana district at D. G. Raja and D. G. Pathan they are in full use for water for drinking in the hot weather. These two villages all almost get their water in the hot weather from these temporary wells or Jhiras. They are made in the bed of the river. They are sunk some 9 to 10 feet and the sides built of *pakka* masonry. In the rains they fill up with sand and are cleared out each year.

In the famine almost all the water obtained for our famine camps was got this way. The establishment of temporary wells in all villages where there are biggish nallahs would be a great protection against drought. In years of drought the people do not need any encouragement to make them, they do it at once but the establishment of these before a year of drought occurs again would be beneficial. It means a long enquiry, but it was started in the Buldana district. I do not know if it was completed.

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1. *Q. (The President.)*—You are Deputy Commissioner here?—Yes.

2. *Q.* How long have you been in the Province?—Almost 9 years. I came in May 1893.

3. *Q.* Have you been here through the famine?—Yes th ough both famines, that of 1896-97 and of 1899-1900.

4. *Q.* Where were you?—I was in the Akola district in 1896 97 and in Buldana in 1899-1900; I think I was in the worst district in both famines.

5. *Q.* It was a distinct famine?—The first one judged by the second could not be called severe; at the time we thought it so

6. *Q.* In the second was there serious loss of life?—Very heavy indeed.

7. *Q. (Mr Higham.)*—The first famine was more among the hill tribes?—It was more in Ellichpore. In Khamgaon and one or two of the Akola districts there was fairly severe famine among the agricultural population.

8. *Q. (The President.)*—And in 1899?—It was very bad indeed; it was all over.

9. *Q.* It was not bad here I believe?—I believe this district was not bad and Wun was lightly struck, but the rest was very badly hit.

10. *Q.* You refer briefly in paragraph 3 of your memorandum to black cotton soil. What do you think of it?—Black cotton soil is not unsuited to irrigation but at the same time it produces crops for which irrigation is not necessary. There is no inherent hardness in black cotton soil.

11. *Q.* As a matter of fact in an ordinary year they would not take water?—No.

12. Q. Would they have taken it in the famine?—They would have taken it for *rabi*, but it was quite useless for *kharif*.

13. Q. What is *kharif*?—*Juar*, cotton, *bajra*, *urd*, and *moong*.

14. Q. They never irrigate cotton?—No, never.

15. Q. During these years of famine did these crops survive?—In the famine of 1896 there was a certain outturn of *juari* and cotton; some of the crops survived; in that year the rain was exceptionally heavy to start with, but failed suddenly in August. In 1899-1900 there was no crop at all.

16. Q. And they would not, if they had wells, have taken it?—Not for the kharif crop. Last year we found they did take it occasionally for the *juar* crop. One kind of *juar* is grown for fodder not as seed.

17. Q. In Egypt cotton is irrigated steadily once in every two or three weeks?—Yes, I know it is; that has been tried in the Berars and was fairly successful, but it was on too small a scale to say if it was a paying crop or not; but they did get a crop.

18. Q. There is a certain amount of well irrigation?—Yes.

19. Q. What do they water from that?—Wheat, garden crops, sugar-cane and ground-nuts; they don't water gram or linseed.

20. Q. Do they grow rice anywhere?—Yes on rice lands; in some places below the bund of a tank and at other places there are natural *jhils* in the rains where the land is naturally very swampy.

21. Q. You say under the bunds of a tank. I suppose there are very few tanks?—I think there are four.

22. (*Mr. Rajaratna Mdlr.*).—Four in the whole Province?—Yes, I don't know of more than four.

23. (*The President.*)—You say in paragraph 5, "Loans are not taken at all freely, because the cost of building a well is high and the uncertainty of finding water is great. The only remedy that I can suggest is the sinking of trial well in various places." That uncertainty is a serious question?—Yes, very serious indeed; two men in Yeotmal have spent over R2,000 and have not got water.

24. Q. Have they worked the rough rock?—Yes, until they came to black stone, and they are now working through it with dynamite; they are both rich men.

25. Q. Do you think under any circumstances?—I think if the term of the *takavi* loans were made somewhat easier, and if, when an attempt to find water was an utter failure, they knew they would not have to pay, they would dig them.

26. Q. Do you mean that Government should take the risk?—Yes; then they would take *takavi* more freely, I think.

27. Q. During the bad year of 1899-1900 were wells doing well?—They varied very much. Some wells did exceedingly well, and some which had never been known to fail before, failed. On the whole, they didn't do very well.

28. Q. You recommend a reduction of interest to 3 per cent.; is it 6 just now?—Yes.

29. Q. Would that make much difference?—They are used to 24 per cent. by the sowcar.

30. Q. You recommend remission of interest for the first two years?—Yes, until they have wells; for the first two years a well cannot possibly pay.

31. Q. In how many years are these advances payable?—The limit is 20 years.

32. Q. What is the custom?—Not more than 15, usually 10.

33. Q. Have you any experience of Government losing?—No, I have not known a case.

34. Q. Do you think there is an unnecessary amount of caution with regard to the system of security?—There is not an unnecessary amount of caution in an ordinary year, but in a famine year, when it is a question of getting money out quickly, our system is very cumbersome, not under the Land Act, but under the Agricultural Loans Act; too many precautions are taken.

35. Q. It being recognized as the policy of Government to encourage wells?—Yes.

36. Q. What do you think of 20 years as the period of repayment?—I don't think it should be lengthened; 10 to 15 years is the custom.

37. Q. I suppose that means that the native subordinate is nervous?—It is given by the Deputy Commissioner or Assistant Commissioner.

38. Q. Why doesn't he give 20 years?—They seldom ask for so much. Between R10 and R50 a year is what a man thinks he can repay. *Capt. D. O, Morris.* 3 Mar. 02.

39. Q. (*Mr. Higham.*)—Do you think they like to repay as quickly as possible?—No, I don't think they are at all keen to get rid of any incubus.

40. Q. (*The President.*)—In some cases you advocate giving a grant-in-aid up to half the cost? Yes, it might be given in certain villages which are destitute of wells at present. I think the people that are better off would make wells for themselves.

41. Q. You say in answer to question No. 6, "There is great desire in all places to construct wells, provided there is a reasonable chance of getting water." What would these wells be devoted to?—Principally garden crops and irrigated wheat.

42. Q. You say in reply to question No. 34, "A well lasts without repairs, of brick 6—7 years, of stone 10—12 years." That is a very short time?—That is about the average.

43. Q. Do they tumble in?—No; but if they are not repaired at the end of that time, they will.

44. Q. Are they built of mortar generally?—Yes, bricks and mortar or stone and mortar.

45. Q. (*Mr. Higham.*)—What happens; how do they fail?—They fall in from the top; they are quite easily repaired.

46. Q. (*The President.*)—You say in reply to question No. 35 (2) that the people do not know how to make goor. What do they do with their sugar-cane?—They sell it by the sticks. They make goor just across our border in Hyderabad, but I have never seen anybody making it in Berar.

47. Q. Have you any sort of Agricultural Department?—Yes, Land Records.

48. Q. What work did you give the people in famine time?—In Buldana they were employed up to May almost entirely on stone-breaking; they began two tanks and the railway.

49. Q. What railway was that?—From Khamgaon to Jalna. It is a light line.

50. Q. (*Mr. Higham.*)—Has that been completed?—No.

51. Q. (*The President.*)—Have you got famine programme in the districts now?—Yes.

52. Q. Are they kept up to date?—Yes.

53. Q. What is the main thing?—I have not seen the Public Works programmes; the smaller works are all village improvements; there is no stone-breaking at all.

54. Q. Does the country lend itself to tank?—Yes, at the foot of the low hills, where the spurs run down.

55. Q. But the country below does not want irrigation?—It would be all the better for irrigation; it won't pay, at any rate I don't think so.

56. Q. Would this make suitable famine relief works?—Very.

57. Q. Making a bund is an excellent form of work?—Yes.

58. Q. So far as you are aware, nothing of the kind has been put in the programme?—I have not seen the Public Works programme; I believe it has.

59. Q. Mr. Grant, has anything been done about tank bunds in the Public Works programme?

Mr. Grant.—No. (Mr. Grant exhibited a map showing proposed sites for tanks.)

60. Q. (*To Captain Morris.*)—What do you think would be the best policy to pursue to make Berar better able to stand famine than it was two years ago; money being granted?—If money is given, I think protective tanks will guarantee all except the actual centre of Berar, in the centre wells only are possible, in the hilly country protective tanks only are possible if there is money.

61. Q. Supposing these tanks were made, is one to expect that the people would develop a turn for growing rice?—Yes, even now they grow rice; they are used to it.

62. Q. (*Mr. Higham.*)—Supposing water is given, do you think that the cultivation of rice would be more profitable than the cultivation of cotton?—I have not been able to find out; my personal belief is that it is not more profitable. The cultivation is on too small a scale; I cannot get statistics.

63. Q. The only point about rice is that it would not be liable to fail in a wet year like a dry crop?—No, water could not hurt it.

64. Q. You have got very little rice cultivation?—Yes, there is only one tank in the district under which they grow

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rice. The cultivation is very small, and I could not get particulars of the outturn.

65. Q. I suppose a good deal of money would be spent in preparing the fields for the rice crop?—No, it is not a costly crop in that way.

66. Q. What about manure? Do they want manure for rice?—I am not prepared to answer the question. I have not got much experience about rice.

67. Q. Do they manure cotton?—They put on a top dressing, but they don't put in manure once the crop is in the ground.

68. Q. You said that, in the case of failure to obtain water from a well, Government should bear the whole cost of the experiment and relieve the man of liability?—Yes.

69. Q. If they bear the whole cost, is there not some danger of reckless attempts to sink wells? Don't you think Government should guard against that?—I think the District Officers would be able to say if a man was trying an experiment merely for the sake of trying it at Government expense.

70. Q. You don't think it necessary he should bear any proportion of the loss?—It would depend upon who the man was. If it was a wealthy man, then Government should only pay half, but a wealthy man won't go in for *takavi* advances very often.

71. Q. I understand that, if a man sinks a well at his own expense, he will be assessed at dry rate until the expiry of the settlement?—He will be assessed at dry rate for good and all. If it is done out of *takavi*, then a certain rate can be put on; otherwise there is no enhanced assessment at all.

72. Q. The assessment cannot be raised?—It cannot be raised on account of improvements made by himself.

73. Q. Is that generally understood?—I think the people know it now, since the revision survey showed it. [illegible] on which people have sunk wells there has been no increase since the revision.

74. Q. I thought you said that in case of well made before the first settlement an increased revenue has been taken. I suppose that is in Mr. Rustamji's paper.

Mr. Rajaratna Mdlr. explained that the maximum dry rate was charged.

Witness.—There is no separate *Bagait* rate now. It is possible, if a man takes a loan from Government under the Land Improvement Loans Act, that under the provisions of section 11 of Act IX of 1886 the Local Government may put on a water-rate. It has not been enforced in Berar, so far as I know.

75. Q. Are there any Zemindars or Mauzadars?—There are small Mauzadars, and in Wun there are Izardars (a man who has taken a whole village under the waste land rules). There are three sets of rules, the 1865, 1875, and 1880 rules; a man leases a whole village from Government for a certain period; the quit-rent he pays increases according to the particular rules that he has taken it under. Under the 1865 rules, at the end of the lease, the village becomes his own on a quit-rent of half the assessment.

76. Q. Is there a large area like this?—In Wun there is.

77. Q. Why were these terms offered to the men?—In Wun there is a large amount of land not under cultivation, and these terms were offered to induce the people to break up the land.

78. Q. Has that been successful?—In one taluka only; in the other talukas a large number of villages fell back into the hands of Government. If they don't pay rent within three months, they fall back into Government hands.

79. Q. Famine was not very bad in that district?—No.

80. Q. Still it was sufficient to strain the resources of the people?—Yes.

81. Q. Is there any attempt to provide a water supply in the waste lands, or do they rely entirely on the rainfall?—They treat them exactly the same as the *Khalsa* lands. They try to induce the people to form a party and lease the villages.

82. Q. Do they do nothing themselves to improve the land?—Very little indeed.

83. Q. They are simply a go-between between the Government and the people?—Yes.

84. Q. If tanks were constructed at the foot of the hills and water given to the people, I suppose Government would be able to charge a water-rate?—Yes.

85. Q. There would be no difficulty?—No.

86. Q. What rates do they charge?—Before the revised settlement, I believe, the rate was at rice land rates, which was from Rs. 6 to Rs. 8 an acre. Under the revision, I believe a special water-rate has been put on three talukas. My district has not been surveyed.

87. Q. Are these old tanks?—Old tanks renovated.

88. Q. By the Public Works Department?—Yes.

89. Q. There are really only four in the whole district?—There may be more; I only know of four.

90. Q. Money appears to have been expended on water storage works during the last famine?—There was very little in the district I was in; in Ellichpur there was some; in Buldana tanks were started, but no new tank was completed.

91. Q. Four tanks were started, but none were completed?—Yes, I think four were started.

92. Q. Do you think they should have been completed?—One would have been very useful if it had been completed; it was biggest of the lot.

93. Q. Do you know its extent?—No, I have not the figures.

94. Q. Will they simply lie as they are till the next famine?—They won't be there unless there is another famine soon; black cotton won't stand the rains in the form of a bund; it will be washed away.

95. Q. I suppose it would be hardly worth while building them? They don't want water?—Yes, they do, but not for irrigation purposes; they want water for drinking. It is a tract where water runs off very fast.

96. Q. Cannot they get water from wells?—They have not got many wells, and they are too deep for irrigation.

97. Q. What do you think of the proposal of making tanks at the foot of the hills?—I think it would be a good relief measure.

98. Q. Could not the water be carried to a distant district?—It would be carried to the plains below for any distance that the tank could irrigate. I think perhaps, if we [illegible], we might raise the water level.

99. Q. Do they make any *bandhs* here to hold up the water?—No.

100. Q. Would that be beneficial?—I think it would be very beneficial; it would probably raise the water level and it would also stop the wash-away of black cotton soil.

101. Q. Why don't they do it?—They used to do it; there are traces of its having been done; they do it in places even now, but I don't know why they have dropped it generally.

102. Q. Was it due to want of money or what?—I don't think the value of that was ever properly put before them.

103. Q. If famine occurred again, would it not be a good way of employing people?—Yes, very useful indeed.

104. Q. Is that proposed at all in the programme of relief works?—No.

105. Q. Have you a programme?—Yes.

106. Q. For Wun district is it not entirely making roads?—No, there are also petty village improvements. The biggest work is the clearing of the forest for cultivation.

107. Q. There are jungle tribes there?—Yes.

108. Q. Did they do anything of the kind in the last famine?—No, the last famine was very light there.

109. Q. Did they make any collection of fodder?—There was grass collected in the district for other districts.

110. Q. Was that not good?—Yes.

111. Q. What other works are there?—There are other minor village works, making fair weather roads, reducing the slope of nalas, clearing out a few small village tanks, and the construction of one or two small village tanks, which are more intimately connected with the villages themselves. The ordinary programme of the District Board is also included.

112. Q. How do you make roads in these black cotton soil districts?—There is no difficulty.

113. Q. Do they metal them?—They *muram* them.

114. Q. These field *bands* have no place in the programme?—No, this is an absolutely tentative question.

115. Q. Do you think it would be worth considering?—Yes.

116. Q. (*Mr. Rajaratna Mdlr.*)—For what proportion of the population is your famine relief programme; is there any rule as to the proportion?—Fifteen per cent. is the extent for which preparation is made.

117. Q. For what period?—Six months.

118. Q. Two tanks were taken up during the famine as relief works; would it be useful to complete these works?—No, I believe there were great engineering difficulties in the way of one of the tanks; a puddle trench could not be made.

119. Q. And as regards the other tanks?—There was no labour to finish it; the labour disappeared.

120. Q. You referred to the 11th section of the Land Improvement Loans Act; is that water-rate charged as a set-off against the repayment of the loan?—The rule has never been worked.

121. Q. What is the interpretation put on it by the local officers?—I think the Local Government can impose a tax, even though the loan is repaid.

122. Q. Would not such an interpretation act as a discouragement to the sinking of wells?—I don't think the rayat had the least idea that there is this proviso.

123. Q. If the rayats are distinctly assured that there would be no enhancement, would that not be an encouragement to them to go in for wells? I think it would encourage them a little; but I don't think in the present state of things they are prevented from taking loans at all.

124. Q. What is the amount of loans that has been granted in the last 10 to 15 years in the whole province?—Practically the amounts of loans are very small indeed; in the famine 2 lakhs were given. *Capt. D. O. Morris.* 3 Mar. 02.

125. Q. How many wells were sunk in the famine with the loans that were given?—I have no information; I don't think the information is extant.

126. Q. You said wheat is irrigated under wells?—Yes.

127. Q. Under wells only?—There is another kind of irrigation called *patasthal*, that is, irrigation from *nalas*. Wheat is not grown under tanks; there is no reason why it should not be.

128. Q. Mr. Rustomji says there has been a decrease under well irrigation?—I think Buldana was very hard hit, and that wells completely failed; I don't think they had taken to well cultivation at all.

129. Q. (*The President.*)—I understand you to say that wheat irrigation under wells is in black cotton soil?—Yes.

130. Q. (*Mr. Rajaratna Mdlr.*)—With regard to the question of loans, don't you think that the rayats themselves prefer long periods for the repayment of loans?—I think they prefer to fix their own time.

131 Q. If they were told that they were at liberty to repay the loan in 30 years, don't you think they would like that?—Yes, no doubt. I don't think there is the least necessity to extend it beyond 20. We have not the zamindari system, and therefore we have not large loans taken.

WITNESS No. 49.—Mr. RUSTOMJI FARIDOONJI, Deputy Commissioner, Buldana.

Answers to printed Questions.

Question 1.—The answers below refer to the Buldana District, and in some instances to the Province of Berar generally. I have served in Berar as a Revenue Officer for a little over 12 years. My acquaintance with the Buldana District as an Assistant and a Deputy Commissioner extends over broken periods aggregating 4½ years. *Mr. Rustomji.* 30th May 1902.

Question 2.—The following is the average rainfall in each month during ten years including the famine year 1899:—

	In. cts.
April and May	0 57
June	5 38
July	9 0
August	6 66
September	6 89
October	1 59
November to March	1 56
Total average of the year	31 65

Question 3.—(1) No. On the contrary, a considerable proportion of the agricultural labouring population sits idle during certain periods for want of work.

(2) No. Most of the plough cattle in Berar are well suited to the cultivation of irrigated land, and their number is well able to meet the expansion of irrigation in spite of the great loss during the late famine.

(3) Far from the supply of manure being insufficient, a great deal of it is wasted or destroyed.

(4) Well irrigation, though on a very limited scale, exists in tracts with various soils in this district and the rest of Berar. Generally speaking, I think the soil in most parts of Berar is suitable to tank and well irrigation. Irrigated black cotton soil is known to yield very heavy crops, although, of course, the construction of wells in such tracts is comparatively costly.

(5) This presumably does not refer to well irrigation to which irrigation in Berar is practically confined. In ordinary years the supply of water in wells constructed for irrigation is sufficient for requirements.

(6) Lack of capital for the initial expenditure is an obstacle to extension of irrigation in the case of persons who have the greatest incentive to bring their lands under irrigation, *viz.*, those owning small holdings. Persons with large holdings have, or can procure, the requisite capital, but they are averse to incur the initial expenditure, as they cannot, or will not, give sustained personal attention which is very necessary for irrigated cultivation. There is no lack of funds for the more expensive cultivation of irrigated crops.

(7) No. But perhaps it would be as well to assure the rayats that they would not be liable to enhanced revenue assessment if they built an irrigation well at their own cost.

(8) There is no uncertainty of tenure on which land is held in Berar.

(9) Berar is not as densely populated as some other Provinces,* and the average holdings are fairly large. The soil is generally fertile, and bad seasons have been few and far between. The cultivators, with comparatively light work, get what they want. The average cost of building a well in Berar is much higher than it is in some other parts of India (*e.g.*, the North-Western Provinces and the Punjab). The people, under these circumstances, have no inclination for or incentive to hard and sustained work, and well irrigation is therefore limited and the area under irrigation has shown for some years a tendency to contraction. There are scarcely any irrigation tanks in Berar, and as well irrigation is expensive, it may be said that the people have not been offered the same facilities for irrigation as in some other Provinces, and in the same degree its benefits have been less appreciated in this Province. There are no rich zamindars in the Province who could construct irrigation tanks. There are some money-lenders and others who hold large areas, but these are scattered over a considerable number of villages.

* Density per square mile in this district=160·8 and including forests =171·5.

The population has enormously increased since the cession of the Hyderabad Assigned Districts, and there is not much room for expansion of cultivation, while the soil must deteriorate by uninterrupted cultivation without any attempt to improve it, as it has done in some tracts which have been longest under cultivation. The extension of irrigation will therefore become in time a necessity in Berar.

Question 4.—No irrigation tanks have been constructed by private capital in this district, and I believe in the rest of Berar. Under the revision settlement, land irrigated from wells (which are all constructed by private capital in Berar) is exempted from enhancement of assessment, on account of the irrigation for the whole period of the settlement.

(*a*) "Lands now under irrigation from wells sunk previous to the original settlement are assessed at the highest dry crop maximum rate of the group to which they belong."

(*b*) "Lands irrigated from wells sunk during the currency are treated in every respect as dry crop lands, and receive no extra assessment on account of water."

With a view to encourage irrigation, I would apply the latter principle to lands irrigated from wells sunk previous to the original settlement, and (2) give an assurance to the rayats that the sinking of wells would at no future time render the lands irrigated therefrom liable to enhancement on account of water. Land irrigated by channels from

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streams is liable to the maximum combined soil and waters rate of R8 per acre. I think the assessment on such land should not exceed double the dry crop rate.

Question 5.—Loans under the Land Improvement Act are not freely taken by the people for the extension of irrigation. The total amount advanced under that Act since 1896-97 is R71,197, of which only R21,640 have been applied to the sinking of 159 new wells. This period covers the scarcity year 1896-97 and the famine year 1899-1900. The total number of irrigation wells in the district is 5,714. From the rayat's point of view, the difficulties are these. There is delay and uncertainty in the disposal of applications for these loans. As a rule, applications are presented after harvest when there is just enough time for sinking and building wells. Thus a large number of applications has to be enquired into at once. To safeguard the interest of Government and those having interest in the land, which is generally offered as security, the enquiry in these cases is unavoidably somewhat* elaborate, and a local enquiry in the first instance is entrusted to a low paid agency, *viz.*, Circle Inspectors getting R20 to R30 a month, who have to value the land and recommend the loan. A Tahsildar or an Assistant with his multifarious duties cannot possibly deal in the first instance with applications as they come. The result of this procedure is delay and uncertainty, and the applicant is probably out of pocket before his petition is disposed of. This difficulty is aggravated during a period of scarcity or famine when applications for loans are more numerous. (2) Another difficulty is the fear of sale of an applicant's land in the event of his not being able to pay an instalment, in which case the * whole loan with interest is payable at once. (3) Again, the hypothecation of his land with Government as security for the loan deprives a person of the means of borrowing for other purposes from his creditors. (4) Lastly, the lands of a large number of the petty cultivators who are most in need of loans from Government are encumbered, and they cannot find security for loans from Government for which they would like to apply for irrigation purposes. For the encouragement of these loans I would suggest the following measures:—

(*a*) To avoid delay in the disposal of applications which is a real difficulty with the rayats, the district staff should be strengthened by the appointment of an additional Naib Tahsildar for each Tahsili, as it is not desirable to entrust the enquiry in these cases to a low paid agency. For a Rayatwari Province like Berar the average charge of a Tahsildar is very heavy, and the proposed additional officer would first attend to applications for loans, and, when he has time to spare, he would give some relief to the overworked Tahsildar. I have no doubt that this would secure appreciable expansion of irrigation by a free grant of loans.

(*b*) If one instalment is not paid in time, the immediate payment of the † whole or balance of the loan should not be demanded, but the particular instalment should be recovered by distraint, if possible, the whole or the balance of the loan being immediately recovered only if Government is driven to sell hypothecated land.

(*c*) Expert advice should be placed within the reach of applicants, and, if necessary, boring tools, to be kept by Government or local bodies, should be hired out to them.

I would also recommend—

(1) Reduction of the rate of interest to 3 per cent. The rate of interest now charged is moderate in itself, but what makes it high is the long period over which the payment of a loan is spread. A low rate of interest would encourage the better class of cultivators to obtain loans for making irrigation wells.

(2) Remission of the interest is not recommended, but it is desirable not to charge any additional interest in case of defaults.

(3) Partial remission of the advance would doubtless ‡ I would recommend partial remission in a year of drought. tend to extend irrigation considerably, but this would entail a great drain on Government resources. ‡

(4) No remission is recommended in case of failure of the attempt to obtain water.

(5) Extension of the period of repayment, combined with reduction of the rate of interest, is desirable.

(6) I would not recommend any grants-in-aid.

Question 6.—The area under irrigation in Berar is so small that it is not possible to test this proportion. However, I do not think extension of irrigation in Berar would tend to injure the remaining cultivation. The people I have consulted are strongly in favour of the means of irrigation being extended to the Buldana District.

Questions 7 to 22.—There are no canals in Berar.

D.—Tanks.

Question 23.—There is only one irrigation tank in this district, and I do not think there are more than a dozen in Berar.

(1) The tank in this district is supplied with water during the rains from the surrounding drainage area.

(2) The water is distributed by channels to the fields.

(3) The supply is ordinarily maintained during the cold and hot seasons. In a year of scanty rainfall or drought the supply is very precarious.

(4) The solitary tank in this district irrigates 230 acres.

Question 24.—No statistics are available, and the landowners I have consulted give conflicting opinions. It would, however, be safe to say that the irrigation would increase the value of the produce from double to treble in case (1), from 5 to 10 times in case (2), and by about 50 per cent. in case (3) (*a*), and considerably more in cases (3) (*b*) and (*c*), the value varying with the prevailing prices.

Question 25.—I am unable to answer this question.

Question 26.—No, this is not the case in the area irrigated from the Sindkheir tank in the Buldana District.

Question 27.—Statistics are not available, and the information obtained by enquiry is conflicting. But it would be safe to say that the increase in the total annual value of the produce per acre would be about 100 per cent. in a normal year and considerably more in a year of drought.

Question 28.—(3) R2 per acre is paid by the cultivator to Government as water-rate in addition to the assessment on the area actually irrigated from the Sindkheir tank.

Question 29.—No reliable information is available.

Question 32.—The construction of irrigation tanks by private persons in Berar is impracticable, as under the rayatwari tenure the holdings of individuals are small and scattered.

Question 33.—The tanks in Berar have a tendency to silt up considerably, and so far very little has been done to prevent this. There are now to be seen the remains of old tanks entirely silted up. It is believed that the normal depth of silt accumulation in many tanks is about 2 feet.

E.—Wells.

Question 34.—The main tracts into which the district is divided are the Purna Valley, comprising the malkapur Taluq, and the table-land above the Ajunta hills, comprising the Chikhli and Mehkar Taluks.

(1) The average depth of permanent wells in the former tract is 50, and in the latter 40 feet.

(2) The supply is from springs in some tracts and from percolation in others. The supply is apt to fail in a year of drought, but the experience of most people during the late famine was that the wells had only to be deepened sufficiently to afford an ample supply. The rainfall, before the late famine, was below normal for some years, and the supply in many wells was therefore scanty. The supply in the wells in the tract along the Purna is somewhat saline, but not so bad as to render irrigation impossible.

(3) The cost of construction of a well ranges from R200 to R1,000, mostly under R300.

(4) From 50 to 100 years, for a permanent well, according to the materials used.

* This is a mistake. Only the particular instalment in respect of which default has been made is recoverable at once. The rule mentioned refers only to loans under the Agriculturists' Loans Act.

† See foot-note to question 5

(5) Water is invariably raised by a "mot."

(6) 2 to 3 acres where one "mot" is working, and double that area where the capacity of the well allows two "mots" to work.

(7) Usually a little less than the above area.

Question 35.—The answer to question 24 holds good.

Question 36.—Vide answer to question 27.

Question 37.—The highest dry crop rate is levied by Government in the case of land irrigated from wells dug before the original settlement, and in the case of irrigation wells made during the currency of the lease (30 years) the dry crop rate applicable to the group to which the land belongs.

Question 38.—(1) Yes. Well-making in many tracts of Berar is more or less an experiment. People seek the assistance of quacks in the selection of a spot, but this assistance is quite useless.

(2) After digging a certain depth, where hard rock is met with, the ordinary villager despairs, and gives up further attempt at finding water. No assistance has been so far offered by Government or local bodies in the shape of expert advice, trial borings, the use of boring tools, etc. I am of opinion that such assistance would substantially encourage the building of irrigation wells. I think the Local Fund Public Works agency should be trained by experts in this respect, and boring appliances should be kept by Government or local bodies at convenient centres, and hired out to persons in need of them, a special staff knowing the use of the tools being maintained for the purpose. Against the additional expenditure which this scheme would involve must be set off the protection it would afford against famine, and the consequent saving in expenditure on relief measures.

Question 39.—I think this proposal is not feasible. Construction of wells undertaken by Government would necessarily be more costly than work done through private agency. Such an undertaking, to be of any value, would be enormous, as a well irrigates a very small area in Berar, and the return in the shape of enhanced assessment (which will have to be slight if irrigation has to be encouraged) will be disproportionately small.

Question 40.—Temporary wells are not possible in most parts of Berar owing to the nature of the soil. Very few were excavated during the late famine, and the protection they afforded was inappreciable.

Area of the district including forest . 2,809 square miles.
Ditto ditto excluding forest . 2,470 ditto.

I

Population according to the census of 1891.				Population according to the census of 1901.				Differences.
Chikhli.	Mehkar.	Malkapur.	Total.	Chikhli.	Mehkar.	Malkapur.	Total.	
150,098	153,046	177,877	481,021	129,622	120,807	173,256	423,685	—57,336
		Density per square mile including forest.	171·2			Density per square mile including forest.	150·8	
						Density per square mile excluding forest.	171·5	

II

Statement showing the culturable area in the Buldana District from the year 1891-92 to 1900-01.

Year.	Acreage.
1891-92	1,318,179
1892-93	1,356,225
1893-94	1,479,084
1894-95	1,476,947
1895-96	1,477,122
1896-97	1,477,244
1897-98	1,477,127
1898-99	1,475,899
1899-1900	1,475,873
1900-1901	1,475,873
Total	14,489,573
Average	1,448,957

III

Statement showing the cropped area in the Buldana District from the year 1891-92 to 1900-01.

Year.	Acreage.
1891-92	1,278,538
1892-93	1,270,342
1893-94	1,257,554
1894-95	1,235,385
1895-96	1,222,621
1896-97	1,078,110
1897-98	1,220,359
1898-99	1,211,407
1899-1900	838,593
1900-1901	1,099,758
Total area	11,712,667
Average area	1,171,266

IV

Area irrigated in normal years.

Year.	Acreage.	Percentage of the irrigated area to the cropped area.
1891-92	18,815	1·5
1892-93	17,826	1·4
1893-94	23,451	1·9
1894-95	13,039	1·1
1895-96	18,251	1·5
1897-98	55,471	4·5
1898-99	35,239	2·9
1900-1901	31,835	2·9
Total	213,927	...
Average	26,741	...

Area in a year of drought.		Percentage of the irrigated area to the cropped area.
1896-97	32,095	2·9
1899-1900	34,220	4·1
Total	66,315	...
Average	33,157	...

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V

Statement showing the area under sugar-cane in the three Taluqs of the Buldana District.

Year.	Area under crop.			
	Chikhli.	Mehkar.	Malkapur.	Total.
1891-92	878	107	66	1,051
1892-93	1,137	180	111	1,428
1893-94	1,457	847	173	2,477
1894-95	1,016	516	101	1,633
1895-96	918	470	90	1,478
1896-97	640	1,048	58	1,746
1897-98	562	1,125	82	1,769
1898-99	857	1,065	60	1,982
1899-1900	715	396	70	1,181
1900-1901	43	60	120	223
Total for 10 years	8,223	5,814	931	14,968
Average for 10 years	822	581	93	1,496

1. Q. (*The President.*)—You have been 12 years as Revenue Officer in Berar?—Yes.

2. Q. You are Deputy Commissioner of Buldana?—Yes.

3. Q. Were you in the Province throughout the famine?—I was in the Province through both famines.

4. Q. You have had some experience of famine management?—Yes.

5. Q. You say in paragraph 3 (4), "Well irrigation, though on a very limited scale, exists in tracts with various soils in this district and the rest of Berar. Generally speaking, I think, the soil in most parts of Berar is suitable to tank and well irrigation. Irrigated black cotton soil is known to yield very heavy crops, although, of course, the construction of wells in such tracts is comparatively costly." Do you think, then, if for the sake of protection against famine Government were to spend money in making tanks, assuming that suitable sites could be found, that the people in black cotton soil would turn from *juar* and grow rice?—I think so. They would certainly turn to crops which can be irrigated.

6. Q. Would it pay better?—I think so.

7. Q. I suppose under no circumstances would they irrigate their dry crops?—They would probably irrigate cotton. In one of the old settlement reports I have read that irrigated cotton yields a much better crop.

8. Q. Now do you come across cotton irrigated by wells?—No.

9. Q. In reply to question No. 3 (7) you say, "Perhaps it would be as well to assure the rayats that they would not be liable to enhanced revenue assessment if they built an irrigation well at their own cost." In paragraph 4 you also refer to this question and you make a quotation. What is that from?—The Settlement Report of the Buldana District. I believe this rule applies to the whole of Berar.

10. Q. What year is that?—Three taluqs were settled in different periods within the last four years.

11. Q. You think the rayat is not quite certain whether he will be assessed heavier on account of his well or not?—So far the present assurance is only for the settlement period. I think it would encourage irrigation if they understood that the construction of wells would not render them liable to enhanced assessment at any time.

12. Q. Are there any cases of land under a well being assessed higher?—Before the present revision settlement there were, but none since.

13. Q. Then probably the rayat does not know all about it?—He only knows that it has been given up for the settlement period.

14. Q. In reply to question No. 5 you say, "Loans under the Land Improvement Act are not freely taken by the people for the extension of irrigation. The total amount advanced under that Act since 1896-97 is R71,197. Is that in the Buldana District?—Yes.

15. Q. Further in the same paragraph you say, "From the rayat's point of view, the difficulties are these. There is delay and uncertainty in the disposal of applications for these loans. As a rule, applications are presented after harvest, when there is just enough time for sinking and building wells. Thus a large number of applications have to be enquired into at once. To safeguard the interests of Government and those having interest in the land, which is generally offered as security, the enquiry in these cases is unavoidably somewhat elaborate." Have you known many cases of Government losing money?—There are not many cases, because we have taken all these precautions. If we made the enquiries less elaborate, the loss would be greater.

16. Q. Do you not think it would be possible to make them less elaborate?—Not appreciably. I think a better agency might be employed in enquiring into these cases.

17. Q. You say, "Another difficulty is the fear of sale of an applicant's land in the event of his not being able to pay an instalment, in which case the * whole loan with interest is payable at once." Is that exercised?—Yes.

18. Q. It seems rather hard?—Yes.

19. Q. Is there any discretion given to the District Officer in the matter?—No, the rules don't allow of any discretion.

20. Q. (*Mr. Rajaratna Mdlr.*)—Is that enforced also as regards takavi loans?—Yes.

21. Q. (*The President.*)—Therefore you advocate the appointment of an additional Naib Tahsildar in each Taluq?—Yes.

22. Q. Specially to attend to this matter?—Yes.

23. Q. You say further in reply to question No. 5 that you recommend the reduction of the rate of interest to 3 per cent. Would that make much difference?—Yes, I think so, because 6 per cent. extended over 15 years amounts to a large sum, and if you extend the period of repayment from 20 to 30 years, as I have recommended, of course the interest would be still more.

24. Q. You say in reply to question No. 23, "There is only one irrigation tank in this district, and I do not think there are more than a dozen in Berar." Do you think the land lends itself to tanks?—I should say so.

25. Q. Have you any experience of Telingana?—Yes.

26. Q. Is it as well adapted to tanks?—Not so well.

27. Q. Would the people take to wet cultivation if the number of tanks was increased?—Yes, in Berar they adapt themselves wonderfully to circumstances.

28. Q. You say in answer to question No. 33, "The tanks in Berar have a tendency to silt up considerably, and so far very little has been done to prevent this." But the whole number of tanks is very few?—Yes, I refer to small tanks for watering cattle. There are very few irrigation tanks.

29. Q. You say also, "It is believed that the normal depth of silt accumulation in many tanks is about 2 feet." In what time?—Two feet a year, I believe; the silting process is very rapid.

30. Q. Do you think if a District Officer had at his disposal boring machinery and some establishment, who would examine and see whether a place is likely to be suitable for wells, it would encourage the sinking of wells?—I think so.

31. Q. What do you recommend as the best policy in Berar in future?—Large tanks, I should think.

32. Q. Do you suppose at any time Berar was a tank province like Telingana?—No.

33. Q. Do you think it had formerly more tanks than it has now?—Yes, irrigation was much more extensive than now.

34. Q. (*Mr. Higham.*)—The figures you give in your note are for the Buldana District?—Yes.

35. Q. I see there has been a decrease in the population between the two censuses?—That is owing to the famines.

36. Q. Has there been any emigration?—Very little, I should think.

37. Q. Were you at Buldana during the late famine?—I was at Akola.

* See foot-note to question 5.

38. *Q.* In 1899 I understand from the figures in statement No. III that the cropped area in Buldana was only about 800,000 acres against 1,500,000 culturable area?—Yes.

39. *Q.* That is to say, a little more than one-half?—Yes.

40. *Q.* That is the worst proportion you have on record?—I think so.

41. *Q.* The average being 1,171,266?—Yes.

42. *Q.* I also see in statement No. IV that the area irrigated by wells actually increased in dry years?—Yes.

43. *Q.* That is to say, that wells did not fail you?—They made more of their wells; many of the wells failed.

44. *Q.* Under well irrigation do you include *kachcha* wells?—Yes, but very few were made in Berar; the soil is very loose, and they must be built up.

45. *Q.* Would that be recorded as well irrigation?—Yes.

46. *Q.* You think the best thing is to increase the number of wells?—I would increase the number of tanks.

47. *Q.* Tanks would be useful?—You could irrigate from them in ordinary years. The normal area of the *rabi* crops is 27 per cent., of the *kharif* 70 per cent., and garden crops 3 per cent.

48. *Q.* Does *rabi* want water?—The yield would be better if watered.

49. *Q.* Supposing wheat is put down, what water is required?—It would require two or three waterings after the rains.

50. *Q.* I suppose about four inches each time?—I am unable to say.

51. *Q.* They don't require to water it every week or ten days?—No.

52. *Q.* Of course you would want more waterings in the event of scanty rainfall; the average rainfall is 30 inches; if you had 20 inches only, you would want more waterings?—Yes.

53. *Q.* How do you get the three waterings. Have you got any instances of tank cultivation?—No. of well cultivation we have and there is one tank in Buldana. I am told they want two to three waterings for wheat, linseed and gram.

54. *Q.* (*Mr. Rajaratna Mdlr.*)—The evidence in other Provinces went to show that the rayats won't take water for black cotton soil?—I cannot speak from actual experience. They have well irrigation to some extent in black cotton soil, and the yield is supposed to be heavier.

55. *Q.* Is the black cotton soil the same here as in Raichur?—In the plain taluqs the black cotton soil is much better than at Raichur.

56. *Q.* There the engineers, etc., said that the people won't take water on black soil for dry crops. Is the soil in Buldana different?—I should say in Buldana it is deeper along the Purna Valley than in Raichur.

57. *Q.* (*The President.*)—We heard that in some parts where the soil is shallow they will take water and where it is deep they won't?—I have not had actual experience. As a matter of fact, they have patches of irrigation from wells.

58. *Q.* The area is small?—Yes.

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59. *Q.* And they are able to manure it heavily?—Yes.

60. *Q.* Are you satisfied if a large irrigation work is constructed, capable of irrigating 30,000 to 40,000 acres, that the people will take water?—Tanks will be very difficult in these tracts. Berar has all manner of soils. In my district along the Purna Valley there is less than one-third black cotton soil.

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61. *Q.* Do you think tanks will hold water in seasons of drought?—I cannot say, I don't see why they should not.

62. *Q.* In your memorandum you say the number of wells in the district is 5,714; is that the total number?—It is the total number of irrigation wells.

63. *Q.* What area is irrigated, roughly?—The average for a normal year is 26,740 acres and for years of drought 33,757 acres. I have taken the average of the two famines.

64. *Q.* The area was small in 1894-95 as compared with 1893-94; it is 13,000 in 1894-95 and 23,400 in 1893-94?—I was not in the district and cannot explain the figures; 1894-95 was a very wet year.

65. *Q.* Is there any reason to believe that the record is not correct?—The record is correct; we get the area field by field.

66. *Q.* What powers have Tahsildars in the matter of loans?—They can only recommend loans; the District Officer or his assistant can grant the loans.

67. *Q.* Up to what limit has an Assistant Commissioner power?—The same as the Deputy Commissioner; up to Rs. 500.

68. *Q.* Have they any power to grant postponement of instalments in seasons of drought?—Yes.

69. *Q.* In such cases is compound interest charged?—No.

70. *Q.* Is a loan treated as a first charge on land mortgaged? A Government loan takes precedence of all encumbrances, does it not?—I don't think so. It could only be recovered after prior mortgages have been satisfied. We don't advance loans if the land is already encumbered to the extent of its value.

71. *Q.* You said irrigation was much more extensive at one time than now. What is the cause of decrease in the irrigated area?—I have not enquired into that.

72. *Q.* Do you refer to irrigation under wells?—Yes, irrigation under tanks is practically *nil*. It is only 230 acres in the Buldana District. There is a certain amount irrigated by channels from streams, but that area is very small.

73. *Q.* Has the decrease under well irrigation been very considerable?—It has been considerable as compared with the figures of the previous ten years.

74. *Q.* How great?—I examined the figures but don't remember the exact decrease.

75. *Q.* You cannot account for the decrease?—Scanty rainfall may have had something to do with it; the rainfall has been scantier within the last five or six years than before.

WITNESS No. 50.—KHAN SAHEB JEHANGIR MUNCHERJI VACHA, Executive Engineer, West Berar.

1. *Q.* (*The President.*)—How long have you been here?—For the last 10 years.

2. *Q.* You have been here throughout the famine?—Yes, in the latter half of the second famine I went home on sick leave.

3. *Q.* From your experience of Berar what would you suggest that Government should do with a view to making the Province better able to stand famine if it should come?—I think tanks would be a great boon.

4. *Q.* Do you think, from your own personal knowledge, that there are many places where tanks could be made?—Yes, in Balaghat and Melghat.

5. *Q.* Is there black cotton soil there?—Would the aynout be black soil?—Yes, but there is an outcrop of *muram*, and the black soil is not deep.

6. *Q.* You see any signs of former tanks in the country?—No; on the contrary, I don't think more than 30 years ago half the country forming Balaghat and Melghat was as much cultivated as it is now. It was mostly jungle.

7. *Q.* One has found elsewhere that where there is black cotton soil they don't take to irrigation. Don't you think that may be a reason why there are not more old tanks in this country?—I don't think so. In the Purna Valley there is rich soil, but in the uplands of Balaghat and Melghat by irrigation you could get a better growth of rice and *rabi* crops.

8. *Q.* From your intercourse with the people, do you think they would take to irrigation, if it were brought to them?—Yes, I am convinced of that; the cultivators and landholders adapt themselves to circumstances readily. Ten years ago there was hardly a Ginning Factory owned by them; at first they were indifferent, but now they are going on building Ginning Factories all over Berars.

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9. *Q.* As a protection against famine, what would you put in the first line?—Tanks and railways also do good. Our present programme is largely for stone metal breaking.

10. *Q.* The famine programme is made, I suppose, by you in conjunction with the Deputy Commissioner?—I did not make it. We have been required to go through it with the Deputy Commissioner.

11. *Q.* Why don't you substitute tanks for the present programme?—That question was not taken up; we might substitute them later on; this programme was made out last year. Tank projects would take some time to prepare.

12. *Q.* Have you any tank projects in contemplation?—I don't think so.

13. *Q.* How many districts have you?—Three.

14. *Q.* What Assistants have you?—One Assistant Engineer and some subordinates.

15. *Q.* Have you not thought it worth while to examine tank sites?—I only joined four months ago; I was on leave.

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16. *Q.* Before you went on leave, you hadn't thought of these tanks?—Yes, I did. I prepared two or three projects in Karinja and Amraoti; they were taken up, but not completed.

17. *Q.* I suppose you will probably substitute something of that sort for stone-breaking?—Yes, I think so.

18. *Q.* The *bandhara* system of irrigation does exist somewhere, does it not?—Yes; in Berar on a very small scale, only for water melons. That can be done in the Purna Valley if we substitute dry cultivation, by building small bunds 7 to 8 feet high.

19. *Q.* Have you seen anything of the *bandhara* system of irrigation?—No; from the water bunded up the fields lower down can be irrigated for a rice crop and a *rabi* crop can be sown above.

20. *Q.* Is that practised at all?—Very little; it is practised in the hilly portions, not in the Purna Valley.

21. *Q.* Is there much water in the Purna?—Only 2 feet now.

22. *Q.* Are the rivers here in deep channels; could you take water out if you had bunds across them?—No; the Purna is sometimes 60 to 70 feet deep.

23. *Q.* What about the Wardah?—I have no experience of the Wardah.

24. *Q.* (*Mr. Higham.*)—You only had relief works on two tanks in Amraoti?—Yes.

25. *Q.* Were they intended for irrigation or village water supply?—Only for village water-supply. If the Karinja tank was completed, there would be sufficient water to irrigate about 1,000 acres.

26. *Q.* Why was it not completed?—It was begun too late in the year.

27. *Q.* When the famine was over?—Yes.

28. *Q.* What proportion of the work was done, do you know?—About half was done.

29. *Q.* And the other one that you referred to?—Only one-third was done.

30. *Q.* Is it proposed to complete the Karinja tank?—The Civil Department did not seem inclined to spend money on it only for the purpose of irrigation.

31. *Q.* I thought it was required for purposes of water-supply?—Yes; but there is sufficient water in the wells now owing to the water in the tank.

32. *Q.* Does the tank hold water?—Yes; to a depth of 25 feet.

33. *Q.* It is half completed?—Yes.

34. *Q.* I suppose the bund is a certain height?—The bund is to the full height, but the project was to increase the storage of the tank by some water channels, and these have not been completed.

35. *Q.* If you could get 1,000 acres under irrigation, you could put on a water-rate?—Yes.

36. *Q.* What revenue would it bring in?—Probably more than Rs. 2,000.

37. *Q.* Should the tank be completed now or would you wait till the next famine?—I think it should be completed now.

38. *Q.* Do you know anything about the tanks that were commenced in the Buldana district?—There were no particularly large tanks in the Buldana district.

39. *Q.* They spent 2 lakhs of rupees?—That was mostly spent on small village tanks.

40. *Q.* The expenditure on famine works up to the end of September is shown as 9½ lakhs?—That does not include expenditure on small works carried out through civil agency. The total expenditure on water storage works was 21 lakhs.

41. *Q.* There are practically no tanks for irrigation purposes?—No.

42. *Q.* Not even in Buldana?—No, they are simply for purposes of village water-supply.

43. *Q.* Supposing tanks were made in the parts you suggest, in Melghat and Melghat, what irrigation would be effected? Would they be used for rice crop cultivation in the rains or for *rabi*?—For rice as well as *rabi*; any rice that is grown is only in those parts.

44. *Q.* They would not be used for *kharif* crops at all?—No, except in very bad years. Ground in these parts is more suited to *rabi* than *kharif*.

45. *Q.* You would rely on *rabi* crops for making the thing pay?—Yes, in places there can also be two crops a year.

46. *Q.* What water-rate would you get?—They would pay 100 per cent. more than they pay now; in fact, I think they will be able to pay even three times the ordinary assessment.

47. *Q.* What would they pay?—R 6 to R 7 per acre.

48. *Q.* Would they pay that for wet cultivation?—Yes.

49. *Q.* In addition to the amount they now pay?—No, that is the total amount, including the amount they now pay, R2 to R3.

50. *Q.* What is the cost of a tank?—I have taken out some data for Berar tanks; it is a very rough estimate, and comes to R500 per million cubic feet of water impounded, taking an average of bunds 70 feet high.

51. *Q.* You don't know the length of the bund?—No.

52. *Q.* What is the capacity?—About 80 million cubic feet.

53. *Q.* Supposing you had a bund 70 feet high, what amount of water would be impounded?—I don't know; it depends on the configuration of ground.

54. *Q.* How did you make that estimate?—By comparison with the existing tanks.

55. *Q.* Would there be earthen dams or masonry dams?—My estimate is for earthen dams; we could also construct masonry dams.

56. *Q.* Are the sites good?—Yes.

57. *Q.* Then about the rainfall; have you any records of rainfall on these catchment basins?—Yes.

58. *Q.* What is the average?—For the West Berar Division it is 32 inches, for the East Berar 35. The average is about 33 inches in the year.

59. *Q.* What would it be in a famine year?—Fourteen inches.

60. *Q.*—What happened to your tanks in a year like that?—They were dry.

61. *Q.* What would happen to the tanks you propose?—They won't be dry. I want to take an average rate of only 19 inches and 3 inches run off.

62. *Q.* Have you many gauges?—Yes, we have rainfall taken in many places in Berar.

63. *Q.* I suppose rain is greater in the hills than in the valleys?—Yes.

64. *Q.* Do you think a rainfall of 19 inches would fill your tanks?—Yes.

65. *Q.* Are there many remains of old tanks in the district?—There are some old tanks, but they don't seem as if they were built especially for irrigation.

66. *Q.* In the Hyderabad country irrigation by tanks has been carried on from time immemorial, but the old tanks have been allowed to fall into disuse. Are there any signs of tanks here?—No.

67. *Q.* Is that not an indication that the conditions are not favourable?—No, I think the valley of Berar was always considered very rich. In those days crops were considered sufficient for the wants of the people, and they didn't want to bring in extra irrigation.

68. *Q.* Why didn't they make tanks in the old days?—Because the crops were sufficient for their wants. Where I propose tanks, there used to be forests.

69. *Q.* In the next famine how are you going to supply the people with water?—In the last famine the whole difficulty was that of water-supply. Government should give a grant of, say, R20,000 to find sites for tanks and deep wells. These tracts are very hilly and contain trap rock and you have to go over 100 feet for ample water after consecutive bad years of rainfall. The water can be utilized for irrigation in ordinary years, and in time of famine it can be utilized for camp labourers and for puddling trenches.

70. *Q.* Would you have to make wells more than 100 feet deep in order to get water for your labourers?—Yes, I would put in tubular wells to work with a pump; something like artesian wells.

WITNESS No. 51.—MR. F. W. FRANCIS, Director of Land Records and Agriculture, Hyderabad Assigned Districts. *Mr. F. W. Francis.*

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Answers to printed Questions.

A.—GENERAL.

1. The answers given below refer to the Province of Berar generally with the exception of the three taluqs of Yeotmal, Kelapur and Wun of the Wun District, with which I am not well acquainted. Having been employed for the last ten years as Settlement Officer to revise the original assessments introduced some 30 years ago, I have acquired a good general knowledge of the Province.

2. The average rainfall in each month of the year in each of the six districts of the Province is as follows:—

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Akola . . .	0·28	0·16	0·19	0·15	0 33	5·00	8·43	5·61	5·17	1·74	0·44	0·35	27·85
Amraoti . . .	0·38	0·28	0·28	0·25	0·47	5·79	9·28	7·09	5 60	1·48	0·59	0·30	31·79
Basim . . .	0·23	0·30	0·33	0·40	0·46	5·69	9·85	7·38	6·83	1·61	0·75	0·27	34·10
Buldana . . .	0·21	0·23	0·24	0·19	0·40	5·22	7·90	5·76	5·44	1·54	0·47	0·20	27 80
Ellichpur . . .	0·37	0 21	0·31	0·20	0·37	6·35	10·32	7·78	6·31	2·10	0·56	0·33	35·21
Wun . . .	0·28	0·21	0·69	0·32	0·54	6·29	11·16	8·62	6·88	2·09	0·67	0·29	38·04
Provincial average .	0·29	0·23	0·32	0·24	0·42	5·67	9·35	6·92	5·94	1·73	0·57	0·28	31·96

The number of raingauge stations in each district is as follows:—

Akola 8, Amraoti 9, Basim 6, Buldana 8, Ellichpur 6, Wun 6; total 43. The figures of rainfall have been made up to the end of the year 1900, and are the averages of from 7 to 40 years' registration. Excluding the record of the Chikalda Station, where the rainfall is unusually heavy (66·42 inches), the average for the Ellichpur district is 28·97 inches and the average annual rainfall for the plains of Berar is 31·16 inches.

3. (1) No.

(2) No.

(3) The local supply of manure would doubtless be insufficient for large irrigated areas, except in the neighbourhood of large towns where the night-soil could be utilized.

(4) Black cotton soil is noted as unsuitable for irrigation under this question. I presume that soil of great depth is referred to. The Province contains a very large area of soil of this description. It lies chiefly in the valley of the river Purna which runs from East to West through the Province. North of this river almost the whole of the taluqs of Ellichpur, Daryapur, Akot and Jalgaon would have to be classed as unsuitable for the extension of irrigation, and south of the Purna a large proportion of the taluqs of Malkapur, Khamgaon, Balapur, Akola, Murtizapur, Amraoti and Chandur would come under the same category. Every district in the Province contains tracts of greater or less extent of deep black cotton soil. But in the neighbourhood of the hills where much of the soil is also black and grows cotton it is often shallow and should be capable of irrigation. The construction of reservoirs could only be undertaken in the hills and the supply of water is not likely to be sufficient to extend to the deep black soil plains of the Province; the area commanded by any such works would not therefore be diminished by unsuitability of soil.

(5) There should be no obstacle on this account. The rainfall statistics show the fall to be ample and certain during the months of June, July, August and September. In this period some 27 to 28 inches should be received. The most uncertain month is October, and it is not uncommon for the rains to close at the end of September; but there should be sufficient rainfall during the four monsoon months to fill any reservoir with a good catchment area.

(6) I do not anticipate any difficulty on this account. There are many large land-holders amongst the Deshmukhs and Patels of the Province who possess and are ready to expend capital on improvements. But before any large work was undertaken the point might be determined by enquiry amongst the land-holders of the area which would come under irrigation.

(7) No khatedar would expect to get the water free of all charge. The imposition of the water rate would rest with the Revenue Authorities and it would not be the policy of Government to impose such a high rate as to prevent the utilization of the water. As the khatedar deals direct with Government in the payment of rent any fears on the score of large enhancements might easily be dispelled.

(8) There is no uncertainty of tenure in Berar; as long as the khatedar pays the Government assessment he remains the registered occupant.

(9) None that I know of.

4. Settlement leases are for thirty years in Berar. Any extension of irrigation during the currency of a lease would remain exempt from enhancement of assessment until the expiry of the lease. All wells sunk during the currency of a lease are regarded as improvements and are as such exempted from any increase of assessment even during the next lease. Lands brought under irrigation by channel from streams (patasthal bagait) during the currency of a lease would be assessed for water at the next revision. I consider these provisions sufficiently liberal. In the Pusad taluq of the Basim district land irrigated from streams has been exempted from enhancement of assessment at the Revision in order to encourage this kind of cultivation.

5. The question can best be answered by District Officers; I have had nothing to do with the administration of loans.

6. The extension of irrigation will not injure the remaining cultivation by attracting cultivators. Almost all the land in Berar capable of irrigation is already in occupation and there will be no fields available for cultivators from other villages. No khatedar would resign a holding in order to act as an occupant's tenant; even if he were to do so the resigned land would be readily taken up.

C.—CANALS OF INTERMITTENT FLOW.

These questions are answered with reference to four villages Shendurjan, Satnur, Malkapur, Khedi. of the Morsi taluq of the Amraoti District which contain the best irrigation under temporary dams to be found in the Province.

Total survey Nos. 208; area 786 acres.

12. (1) The water in two large nalas is held up by temporary dams (bandharas) thrown across the stream; these dams are washed away in the monsoon and have to be reconstructed each year. These appear to be springs coming to the surface in the neighbourhood of these dams; the following remarks were recorded at the original settlement by Major Elphinstone regarding these streams. "In the month of January, when I visited them, they appeared to have very little water, but they supplied actually 24 'bunds' or dams within the course of a few miles only. I endeavoured to trace these streams to their source; but, from my

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finding their beds perfectly dry from about one mile north of Satnur up to the very foot of the hills, it is evident there must be several under-ground springs, which keep up the abundant supply which is so regularly drawn off by the numerous dams and their water-courses." My inspection of these dams 28 years later showed that conditions had not in any way altered the supply of water being just as plentiful as it was when the original record was made in the classification papers.

(2) The water is distributed to the land by channels led from the side of the dam; the division of the water is by mutual agreement amongst the cultivators using any particular dam, and depends on the area under cultivation and the kind of crop grown.

(3) (*a*) In a year of ample rainfall the supply is maintained in the best cases till the end of May; in others it will not last longer than the end of January.

(*b*) In a year of scanty rainfall the period would be shortened by about two months.

(*c*) In a year of drought the supply might altogether fail; much would depend on the character of the monsoon rains. If one or two heavy floods occurred there would probably be some supply from the bandharas.

13 and 14. We have no reliable information of the outturn of garden crops and the question cannot be answered.

15. Almost all the land under irrigation from these bandharas is also commanded by wells, but the wells are not worked whilst the supply from the bandhara is available, they are only brought into use when the water ceases to flow in the channels. In the case of crops requiring a perennial supply of water, such as plantains or sugarcane, water from wells would have to be continued until the commencement of the rains.

16. No reply can be given; see answer to questions 13 and 14.

17. (3) The average annual rate per acre paid on account of irrigation is as follows:—

When the water lasts till the end of January only, Rs. 1-8 per acre. Water till the end of March, Rs. 3-8. Water till the end of May, Rs. 4-8 to Rs. 5-0.

The rate is paid on the area ordinarily irrigated, such area being fixed at the time of settlement from the average area of the previous five years according to the village record.

(4) No royalty is paid on the bandharas.

18. The khatedars taking the water assemble together and construct the bandharas and clear the channels; they really incur no expenditure as they do the work themselves. The cost of the work is generally estimated by the classer and divided amongst the khatedars according to the area of their holdings; it amounts to between one rupee and five or six rupees a head.

19. To our knowledge the irrigation under these bandharas has been continued for 30 years, and as far as we know neither damage has resulted to the people nor deterioration to the soil.

20. The reply has been given under Question 18; the cost would not amount to more than two rupees per acre irrigated. The system works so well that the people would resent interference.

21. The question does not appear applicable to bandharas.

22. The construction of bandharas should be encouraged in every way; this can be done by remitting the water rate, as lately sanctioned in the case of the Pusad taluq. But much must depend on the enterprise of the cultivators, who at present are satisfied with the profits obtainable from their kharif crops, cotton and juwari, and will pay but scant attention to irrigation schemes. A large fall in the price of cotton would probably result in the extension of irrigation in the Province.

E.—Wells.

The answers to these questions refer to the Province generally.

31. (1) I should say 20 feet might be taken as an average depth of a permanent well; this refers to the depth of the surface of the water from the ground. There would usually be 9 feet of water in the well.

It is of course difficult to give an estimate for the whole Province as the depth of wells varies greatly. In a tract of land about 2 to 5 miles from the foot of the Satpurns in the north of the Province, extending through the Jalgaon and Akot talugs of Akola and the Daryapur and Ellichpur talugs of Ellichpur, water is easily obtained near the surface at about 10 to 15 feet depth; it is in this tract that our most valuable garden cultivation exists. But on the other hand in the Chikhli taluq of the Buldana district a well might have to be sunk 40 feet before water was reached.

(2) The supply of water is nearly always from springs and is as a rule not liable to fail in ordinary years, but in many cases would do so in a year of drought.

(3) The average cost of construction would be from Rs. 300 to Rs. 500 unless expensive blasting operations had to be undertaken.

(4) A well constructed well might be expected to last for from 60 to 100 years; there are many wells in the Province still in good repair that were in use long before the original settlement took place 30 years ago.

(5) Water is raised from wells in the usual manner by buckets drawn by a pair of bullocks.

(6) From 3 to 4½ acres.

(7) About 4 acres.

35 and 36. I cannot answer these questions as we have no reliable figures of the produce of irrigated crops.

37. (2) This would vary from 6 annas to 1 rupee per acre according to the situation of the village. Well lands are assessed at the maximum dry crop rate of the assessment group to which the village belongs. The figures are arrived at by deducting the assessment of the land at ordinary dry crop rates from the maximum rate, the difference representing the charge for water.

The rates are paid on the average area irrigated, such average being fixed at settlement time from the village record of the previous five years.

38. I cannot answer this question from personal knowledge.

39. I am not in favour of the construction by Government of wells in land which is private property. The fact of there being a well on the land would undoubtedly increase its value and would probably act as an incentive to the occupant to raise a mortgage on the property; in this case I do not see how the interests of Government could be protected. Supposing Government expended Rs. 500 on sinking a well in private property and required a return of 6 per cent. per annum on the money. Taking 4 acres as the area irrigable, Rs. 7-8 per acre would have to be paid as water rate. This would not of course swamp the profits, but it would be regarded as a terribly high rent in comparison with the rates ordinarily paid and might lead to prevention of occupation.

40. Temporary wells, such as those easily constructed in Gujarat, are not used in the Province of Berar. Water is not sufficiently near the surface to render their construction feasible.

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1. *Q.* (*The President.*)—You have been for a number of years in this Province?—Ten and half years.

2. *Q.* Doing settlement work?—Yes.

3. *Q.* So you know the whole of the Province?—Yes; except three talukas of the Wun district.

4. *Q.* What is your feeling about black cotton soil here, as regards its capability of irrigation, we found this problem over a considerable part of India; the soil we were told in nine years out of ten does not want irrigation and in the tenth year it wants it badly; is it due to prejudice on the part of the rayats that they won't take it every year?—The difficulty is in Berar to get water to the deepest black soil.

5. *Q.* What about the shallowest black soil?—That could be irrigated.

6. *Q.* If we made tanks here, would the rayats take water?—Yes; I think so. It would have to be proved to them that irrigation would give more profit than *kharif*.

7. *Q.* Who is to prove it?—They would learn it.

8. *Q.* At time of drought they would run to it, would they stick to it?—My doubt is whether we should get water in the drought. It often happens that rain comes down in a rush and is lost altogether. I think the rayats would use the water if it was there.

9. *Q.* I rather gather that this was never a Province for tanks?—*No.*

10. *Q.* Do you know the Hyderabad territory generally?—No, I have been in the Bombay District and in the Deccan.

11. Q. You say in reply to question No. 3, "in the neighbourhood of the hills where much of the soil is also black and grows cotton, it is often shallow and should be capable of irrigation. The construction of reservoirs could only be undertaken in the hills and the supply of water is not likely to be sufficient to extend to the deep black soil plains of the Province; the area commanded by any such works would not, therefore, be diminished by unsuitability of soil." That is very important?—Yes, I think it is true.

12. Q. With regard to expense, our instructions are not to look out for profitable works but works that are a protection against famine. If one could be sure that tanks could be made here and that the people would avail themselves of them, it is our duty to bring the fact to the notice of Government?—I think they would be availed of if they were there; I don't see any reason to doubt it.

13. Q. What would the profits be like?—I'm afraid I cannot give any statistics; the Land Records Department here is rather a young one.

14. Q. Mr. Rajaratna Mdlr. would tell you that in Madras outside black cotton soil they would take to wet in preference to dry cultivation.

15. Q. (*Mr. Rajaratna Mdlr.*)—That would be rice?—There is no reason why they should not do it here.

16. Q. (*The President.*)—I suppose the last famines were almost unprecedented here?—Yes.

17. Q. What happened in 1896?—I don't think there was any failure in Berar. Our first famine in 1896-97 was more high prices than anything else.

18. Q. You allude in paragraph 4 to lands being brought under irrigation by channels from streams (patasthal bagait). Is there much of that?—No, there is not much in Berar; it is chiefly found in the hill provinces to which I allude.

19. Q. Is there any means of encouraging that?—I think it is capable of extension in parts of Berar.

20. Q. You say in the same paragraph "In the Pusad taluq of the Basim district land irrigated from streams has been exempted from enhancement of assessment at the revision in order to encourage this kind of cultivation?"—Yes.

21. Q. You say in paragraph 4, "all wells sunk during the currency of a lease are regarded as improvement and are, as such, exempted from any increase of assessment even during the next lease." If a man makes a well, is he called upon to pay wet rates afterwards?—We assess wells at the maximum dry crop rate.

22. Q. For the first settlement has he to pay the same as before?—The enhancement will be made at the next settlement but one, not at the succeeding settlement, till then the ordinary dry crop rate remains in force.

23. Q. Do they all know that?—After the revision survey has been introduced they know it.

24. Q. What is irrigated in these four villages in the Morsi taluka that you refer to in the paragraph under "Canals of intermittent flow"?—Sugarcane, plantains, wheat and vegetables.

25. Q. (*Mr. Higham.*)—Do they grow rice?—There is very little rice.

26. Q. (*The President.*)—The whole thing is only 786 acres?—That is big for Berar.

27. Q. Can you suggest anything being done to encourage these bandharas?—I think Government might well build these dams, it would require some survey of the country and some knowledge of the water-supply.

28. Q. To see that one does not interfere with the other?—Yes, and to see how long the water will last, many of the bandharas only supply water to the end of January.

29. Q. Is there any well irrigation along the bed of the nallahs?—There are budkis.

30. Q. Is there much scope for improvement?—Yes, I think there is.

31. Q. Is it on account of the black cotton soil that it is not extended?—No. It is due to the people's laziness.

32. Q. Is that a thing Government could take up and encourage?—District Officers might preach it to the people. I don't see how Government could construct these.

33. Q. What do they pay?—They are assessed like wells.

34. Q. Would it be a good plan to recommend that the assessment should not be increased at all?—I think it would be a very good plan.

35. Q. I suppose the amount of money is not a large item of revenue?—Not at present certainly.

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36. Q. Do you think there is much to be done in the way of increasing the number of wells in the country?—Yes, I think they might be increased a good deal; it would have to be done on a system of loans.

37. Q. Is there any way that you can suggest by which Government might make that system more popular to the people and more easily managed?—I have not had any experience of the administration of loans, not being a District Officer; I should think the term of repayment might be extended and the present rate of interest slightly lowered.

38. Q. It is now 6 per cent.?—Six and a quarter.

39. Q. What would you lower it to?—3½ per cent.

40. Q. Would that be an inducement to them to come forward and apply for loans?—I think so.

41. Q. (*Mr. Higham.*)—Can you say what the rainfall goes down to in your famine years?—12·85 inches against an average of 38 inches in the previous ten years.

42. Q. Was that in the worst district, Buldana?—Akola was the lowest, the rainfall went down to 9 inches.

43. Q. Which were the most distressed districts?—Akola, Buldana, and Basim.

44. Q. The worst rainfall is about one-third of the average?—Yes, we have been down to that.

45. Q. In regard to the extension of well cultivation I suppose that there are some tracts which are more marked out for that than others?—I think so.

46. Q. Supposing Government decided to offer special encouragement to well cultivation, in what tracts would that be most profitably done, would it be in the central part of the district?—Any part but the deep cotton soil. I would exclude the valley of the Purna altogether.

47. Q. You would not recommend works there?—No.

48. Q. Why?—The water is saline, besides it is at a great depth; formerly they manufactured salt in that part of the country.

49. Q. In what part are wells most required?—With the exception of the deep cotton soil, which is found here and there all over the Province, any other part is suitable for wells, except of course the plateaus.

50. Q. The depths there would be too great?—Yes.

51. Q. Do you recommend that, if advances are made for wells, they should be remitted if a well is not a success or if water is not found?—I think you would have to stipulate how far a well was to be carried before any remission was allowed.

52. Q. Would you give total remission or require the applicants to bear a part of the cost in case of absolute failure of water, supposing a well had to be given up?—I think the man would be entitled to absolute remission.

53. Q. You don't think if you had no restriction at all that that would lead to a number of reckless applications?—Of course the holdings of the applicant would have to be examined. I don't think any man who had no probability of getting water would apply for loans. They might, if they knew it would be remitted absolutely in case of failure.

54. Q. Do you think they require expert assistance in sinking wells, or do they know as much as anybody else?—Expert assistance would be useful, but I think we have a sufficient number of wells in the country to pretty well determine the spots in which water could be advantageously found and worked.

55. Q. As regards wells to be carried through rock, could they manage that themselves?—They do it by blasting.

56. Q. Do they understand all that?—Yes.

57. Q. Supposing you make wells and there is a great increase in their number, is there any danger of their not working them after they had been made?—I don't think there is any fear of that if a man struck a good well; if there was only a very poor supply of water it would probably be thrown up.

58. Q. In an ordinary year, when you get good rainfall, they would be able to do without their wells, or do you think they would grow a higher class of crops?—They would certainly grow better crops, such as vegetables.

59. Q. The objection has been urged of forcing the construction of wells in these tracts, that the people might not be inclined to use them for higher class crops and that they would practically fall into disuse?—I don't think that would apply in Berar.

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60. *Q.* Are you in favour of trying to extend irrigation by means of tanks at the foot of the hills?—Not in preference to wells.

61. *Q.* I suppose they would improve the supply in the wells, if they were made?—Yes. I had an instance in a small area of irrigation in Morsi, that is all covered by wells.

62. *Q.* Are there *bandharas*?—Yes, the wells get the *bandhara* supply; the whole of the area is covered by wells, and the water is 8 feet nearer the surface than in the case of wells not so commanded.

63. *Q.* Have *bandharas* been made recently? They were made when we took over Berar?—Yes.

64. *Q.* Do they use the wells to supplement the supply of the *bandharas*?—Yes.

65. *Q.* In Madras and Hyderabad it appears that wherever means of irrigation are introduced, land is at once converted into rice cultivation. You don't think that would be the case?—It would not be entirely rice here by any means; they may grow some rice; they would grow a good deal of wheat I think.

66. *Q.* Does want of water prevent their growing wheat now?—We have a lot of dry wheat in the Province but it very often fails for want of rain or one good watering. If they made certain of that from a tank they would certainly grow wheat.

67. *Q.* A limited amount of water would go further in maturing a wheat crop than in being devoted to the cultivation of rice?—Yes.

68. *Q.* From a protective point of view that would be an advantage?—Yes.

69. *Q.* They would not go in entirely for rice?—No.

70. *Q.* Have you a large tract under irrigation?—No.

71. *Q.* Practically the whole Province is dry crop cultivation?—Yes. There is a little rice grown in the Province but that is only in the depressions.

72. *Q.* Where are these *bandharas*?—They are in the north-east corner of the Province (map shown).

73. *Q.* Are there any on the Wardah?—No, it is too deep.

74. *Q.* Do you think it would be worth while to put permanent ones in Morsi?—There is one permanent one in Morsi taluka which was built by Government and which has gone out of repair; we are taking steps to get it repaired again.

75. *Q.* Do you think anything could be done in the way of construction on some of the other rivers?—I think it might be a good deal extended; the big rivers are too deep in the bed but there are many small streams which would be useful for *bandhara* irrigation.

76. *Q.* Would the people make them themselves if they were given advances for it?—They might.

77. *Q.* They have not shown any forwardness yet?—It is undeveloped at present certainly.

78. *Q.* Have any attempts been made to get water out of the big or perennial streams by pumping?—No, I have not heard of any pumping.

79. *Q.* I suppose 20 to 30 feet would be quite practicable?—Quite.

80. *Q.* Has nothing of the kind ever been attempted?—No, except the Akola water-supply which is pumped from under-ground springs.

81. *Q.* As regards black cotton soil, you say irrigation may be applied to it whenever it is shallow?—That is my impression.

82. *Q.* And not in the deep?—I would not advise it in the deepest parts.

83. *Q.* I think, generally, there seems to be plenty of evidence that crops can be grown on black soil by means of irrigation but it does not pay people to do it. They get more out of dry crops?—Yes, our cultivators are very conservative; the *juari* and cotton crops comprise 70 per cent. of the whole cultivation.

84. *Q.* Are the holdings very large?—Some are where the lands are held by Deshmukhis and Deshpandes, but as a rule they are not large.

85. *Q.* An ordinary rayat would not have more than he could cultivate?—No.

86. *Q.* What is the size of an ordinary holding?—15 to 20 acres.

87. *Q.* Still it would pay a man better to have two acres of dry than one of wet?—I think one acre irrigated would pay better than two dry; it would give him two crops.

88. *Q.* That is after allowing for the preparation of fields with manure and other expenses?—Yes, he could get his *kharif* crop without water, then he could turn on water and grow vegetables.

89. *Q.* How do the profits of rice compare with dry cultivation?—We have no statistics of rice crops so I cannot say.

90. *Q.* (*The President.*)—The rice area is a small one?—It is 50,000 acres; it is not irrigated, it is grown in low-lying black soil fields and only gets the drainage.

91. *Q.* (*Mr. Higham.*)—What period of time do you recommend as a maximum for the recovery of loans for wells and *bandharas*?—I have had nothing to do with the administration of loan money; I think the time should be extended to, say, 15 years.

92. *Q.* And what rate of interest would you allow?—Half the present rate I think.

93. *Q.* The rates that they pay where you have irrigation don't depend on the actual area cropped, do they?—We take an average of five years and assess that for the next 30 years.

94. *Q.* Do they get remissions for failure?—Remissions have been given for land under tanks sometimes but not for *bandharas*.

95. *Q.* And under wells?—Perhaps in a famine year.

96. *Q.* Have you records of the areas actually cropped every year as compared with the areas sown?—No, these figures are got out for the famine year only, not for an ordinary year.

97. *Q.* The area that is sown every year is recorded?—We get figures of the net area cropped, the net area sown and matured.

98. *Q.* In the case of remissions being given, is the area cut out?—I am not a District Officer. I am not well up in these points about remission.

(*Addressing Mr. Rustomji Faridoonji.*)

99. *Q.* Can you give us some information on this point?

(*Mr. Faridoonji.*)—We gave no remissions except during the famine year.

100. *Q.* Does the cropped area exclude the area on which you give remissions?

(*Mr. Faridoonji.*)—It includes that. The cropped area is the area sown, a considerable proportion of that yielded nothing, in fact there was a total failure of crops in 1899-1900 except in parts of the Wun district. We called the cropped area the area which was sown.

101. *Q.* (*The President.*)—(Addressing Mr. Francis.) There was formerly a certain amount of sugarcane?—Yes, it has almost entirely died out of Berar now.

102. *Q.* Why?—There were five years of short rainfall before the famine and during that time the water began to go lower and lower so the people began to give it up.

103. *Q.* Would they commence again if there was a good rainfall?—They would have to import the seed.

104. *Q.* (*Mr. Higham.*)—I have heard that the amount of garden crops in Berar is less now than before, what is the existing state of affairs?—In 1896-97 the irrigated area in Berar was 63,000 acres, in 1900-01 it was 68,000, so that it had gone up 5,000 acres in that time; that area is almost all under wells.

(*Mr. Faridoonji.*)—In the last 10 years it has gone down; in the famine year there was a good deal of wet cultivation.

105. (*The President.*)—Did the people make anything out of sugarcane?

(*Mr. Francis.*)—Yes, in the olden days they made *gur*.

106. *Q.* We understood from some witness that they didn't know how to press it?—I don't think that is the case.

107. (*Mr. Rajaratna Mdlr.*).—I don't understand your statement of assessment on well lands. Mr. Rustomji Faridoonji's memorandum stated that on lands under wells sunk before the original settlement the highest dry rate was charged?—That is right?

(*Mr. Faridoonji.*)—There is a distinction between lands irrigated under wells in existence before the original settlement and lands irrigated by wells made since; in the one case there is the highest dry crop rate and in the other the ordinary dry crop rate.

108. *Q.* (*Mr. Rajaratna Mdlr.*)—Do you think it would be an encouragement to extension of wells if they were permanently exempted from enhancement?

(*Mr. Francis.*)—Yes, I should be very glad to recommend it.

109. *Q.* The loss to Government would not be much?—No, very little indeed.

110. *Q.* At the same time the reduction would be appreciated by the people?—Yes.

111. *Q.* Is any ryat at liberty to throw up a portion of the land in his *patta* that he does not want?—I don't think he can resign a portion of the holding.

112. *Q.* Could he resign it to Government?—No. There may be a number of survey numbers; he can resign a survey number certainly, but he could not resign a portion of a number; a survey number is 15 to 20 acres.

113. *Q.* In the case of irrigated lands no option is left to throw up irrigation?—Not under a bandhara; the water is there?

114. *Q.* He might like to escape it?—He would have to petition through the Deputy Commissioner to get off the water-rate. *Mr. F. W. Francis.* 30 May 02.

115. *Q.* I mean resigning completely; not resigning the right of the water only?—There is no difference between the two.

116. *Q.* Is there any estimate as to the area which you might consider as protected?—That would be the irrigated area of the Province.

117. *Q.* If you take the worst famine year?—It would be 63,000 acres; that is very much the same as an ordinary year.

118. *Q.* What is the area in occupation, including grass lands?—6,820,000 is the area cropped.

119. *Q.* Would the ryats instead of repaying loans, granted for sinking wells, prefer a small additional charge as a permanent increase to their assessment?—How much?

120. *Q.* Sufficient to cover the interest?—I cannot say how that would work; I have had nothing to do with the administration of these loans, it is done by District Officers; enquiries would have to be made, the idea has never been started in the Province yet.

WITNESS No. 52.—MR. A. GRANT, Superintending Engineer, Hyderabad, Public Works Department.

Answers to printed questions.

Population, areas, etc.—The population of Berar according to the last census of 1901 is 2¾ millions. Seventy-five per cent. of this population are entirely supported by agriculture. Thirty-five per cent. of this consist of landless field labourers, and about the same percentage is made up of cultivating occupants or tenants, many of whom are a little superior to labourers. Thus 52 per cent. of the total population are labourers depending entirely upon agriculture.

Population.

The total area of Berar is 17,750 square miles, with an average length of 150 miles from east to west, and 120 miles from north to south.

Area.

Of this total area of, say, 18,000 square miles, 71 per cent. or 12,600 square miles is considered culturable, the average cropped area being 97 per cent. of the culturable area. Of this cropped area only about 93 square miles, that is, less than decimal 8 per cent. is irrigated, chiefly from wells and in one or two instances from small tanks.

General character of the soil.—Berar is divided into three distinct parts. The small hilly tract to the north, known as the Melghat, formed by the Gawilgarh hills, the most southerly range of the Satpura mountains.

The other two large portions of Berar are the valley of Berar in the middle, stretching far north, north-eastward to the boundary of the Central Provinces, and the Balaghat or the up-land country of the Ajunta ridge, forming the northernmost portion of the Deccan trap plateau.

The first which forms a very small portion of Berar is extremely rugged, and broken into a succession of hills and deep ravines. The hilly portion is basaltic, and calcareous rock, and the ravine portion is formed of a light brown alluvium overlying basalt, accumulated from superficial rain-wash from the hills. This light brown soil, extending to about 8 or 10 miles from the foot of the hills towards the valley of the Purna, is culturable, but not so rich as that in the valley of the Purna.

Northern portion, Melghat.

The second and the most fertile, important and thickly populated portion, consists of rich black alluvial soil with land undulating sufficiently to allow of a natural system of drainage. This practically flat tract, measuring 140 miles long by 50 wide, is broken only in one place by a small range of hills near Amraoti. This small range serves to form the watershed of this valley, with the river Purna running through three-fourths of its length from east to west, and the tributaries of the river Warda draining the easternmost portion.

Valley of the Purna.

The Balaghat, or the southern hilly half of Berar is formed of undulating high land of the Deccan trap, interspersed with low and mostly barren hills, covered with stunted teak and jungle trees. The flat top plateaus are covered with shallow but fairly rich alluvial soil and cultivated in most cases, while the intermediate valleys consist of alluvial soil of remarkably fine quality of loam, very suitable for wheat crops. *Mr. A. Grant.*

Balaghat.

Description of soil and its distribution over the country.—Rich black alluvial soil covers the whole of the low-lying lands of Berar. It is either black loam overlying basalt, as in the Ellichpur and Amraoti districts forming the eastern northern half of Berar, or a rich black alluvial vegetable mould as in the case of Akola and portions of the Buldana districts. In the latter case the soil goes down to a great depth with very thick underlying strata of yellow clay and lime, except in portions, mostly near hills, where it is shallow and overlying muram or yellow clay. 30 May 02.

Valley of the Purna.

A great deal of the Purna alluvium, about 10 miles on either side of the river, produces efflorescence chiefly of salts of soda, and in many places wells sunk in this tract have brackish water.

A definedly marked saline tract commences just south of Akola, and passes thence north-eastwards towards Daria-pur taluq, forming a belt about 10 miles broad from east to west and about 50 miles in length.

In the Balaghat or the southern hilly half of Berar, the soil consists of shallow alluvial overlying decayed trap or hard muram, with repeated outcrops of trapstone. In parts where hard muram crops up to within a foot of the surface, the soil covering it is very inferior and unculturable. The low-lying culturable portions form the best ground for rabi crops, such as wheat and gram.

Balaghat.

General experience as to the irrigation requirements of different soils.—The rich black alluvial soil in the immediate vicinity of the Purna does not require much irrigation as the soil is very deep, and sufficiently retentive of moisture. The shallow alluvial soil overlying yellow clay or muram in portions of the valley of the Purna, as well as the whole of the culturable portion of Balaghat, will yield much better crops if irrigated.

Experience as regards black cotton soil.—Small tanks constructed in such soil hold water, but have a great tendency to silt up rapidly, with the result that there is a mere pool left in many of such tanks at the end of the hot weather, whilst some dry up entirely. High earthen dams can be made of it without a masonry core wall, with an ordinary puddled core to a maximum height of 70 to 100 feet.

There is practically no irrigation in black soil in Berar. Where there is deep rich black soil, excess of water produces water-logging, and such tracts will only require irrigation in case of prolonged drought.

Where the black soil is shallow, even in years of ordinary average, but badly distributed rainfall, there is always a great demand for water for irrigation purposes.

Mr. A. Grant.

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Where the black soil does not go down to any great depth, construction of irrigation works are considered remunerative and as important as for other classes of soil.

State irrigation works.—There are no regular State irrigation works in Berar, with the exception of small tanks at Karinja, Ambona, Risod and Sindkhed. Irrigation has been carried out from these tanks only to a very small extent, chiefly for garden and rabi cultivation in their immediate vicinity.

In years of average rainfall these tanks hold water, but in years of drought the water level is too low for any irrigation.

Since the first drought of 1896-97, these tanks have not been used at all for irrigation purposes.

New irrigation works.—No irrigation works of considerable size have been proposed, or any special investigation undertaken for the consideration of the Irrigation Commission, but it is believed that large-sized storage tanks can be constructed.

Large tanks with 20 to 60 square miles catchment areas can be made distributed over the Balaghat, as likewise on south of the Melghat hills.

No irrigation from the river Purna is considered feasible for the Purna valley, as the bed of the river is 50 to 70 feet below the banks, and the fall of the river bed is very slight.

This is the only partially perennial river in Berar. The only two other rivers of importance are the Warda and the Painganga, forming the eastern and southern boundaries of Berar.

No investigations have been made as to the feasibility of irrigation from these two rivers. But as such investigations have been made for the Central Provinces, any irrigation scheme from the river Warda, if found feasible, the same would equally apply to the eastern portion of Berar.

No irrigation scheme on the river Tapti, forming a portion of the northern boundary, can be of any use to Berar.

Tracts and areas for new irrigation works.—There are two portions of Berar, where irrigation can in the first instance be tried with advantage. One is a tract to the south of Melghat, measuring 100 miles long from east to west, and of an average width of 8 miles or about 800 square miles in area. The other is that which can be irrigated by the rain-water run off from the Balaghat plateau and hills. This approximately may be taken as measuring 150 miles long and of an average width of 10 miles or about 1,500 square miles.

Allowing that 500 square miles of this cannot come under irrigation, there will remain a balance of 1,800 square miles which can be irrigated, or one-seventh of the total culturable area of Berar.

Village or private irrigation works excluding wells.—There are no private irrigation works or village tanks intended for irrigation in Berar. As regards the former, there is no probability of any being constructed for years to come, and as regards the latter, they will never be remunerative, as, besides being liable to silt up, they will not hold water when most wanted.

Crops irrigated—Distribution and duty.—There are no irrigation works worth mentioning in Berar. The little irrigation done, being garden cultivation, and watering to rabi crops on very small areas mostly from wells.

The only data available as regards watering crops are those of 1874, when Doctor Reade, Executive Engineer, took observations for three consecutive years in connection with rabi crops from the Sinkhed tank, and found that three waterings of 4 inches were required for irrigation of wheat in average years.

Famine Relief Works.—No irrigation works were undertaken during the famine.

Famine labour was chiefly employed in breaking stone metal, also on road and railway embankments, excavating reservoirs with silt traps, and in constructing and improving a number of small tanks.

Of the total expenditure incurred on famine works, *viz.*, Rs. 92½ lakhs, 53½ per cent. were spent on stone metal, 6 per cent. on road earth-work, 15½ per cent. on railway embankment and stone ballast, 10¼ per cent. on tanks and reservoirs for water-supply, and 14½ per cent. on establishment, tools and plant, and hutting for relief workers.

According to the programme for the next famine, 80 per cent. are proposed to be spent on stone metal, 5½ per cent. on earth-work of roads, 6 per cent. on railway embankment and stone ballast collection, and 8¾ per cent. on tanks and reservoirs, out of a total sum of rupees one crore and eighteen lakhs.

The present famine programme has been prepared in case of any immediate famine, and the large quantity of stone metal provided for in the programme will be required during the next ten years for existing and other roads proposed to be metalled.

But if the next famine does not occur for the next ten or fifteen years, it is likely by that time some light railways will have been constructed in Berar mostly along existing roads. In that event such large quantities of stone metal will not be necessary and it is desirable that projects for storage tanks as famine works should be prepared as soon as the necessary special establishment is available for that purpose.

Wells.—Depth of permanent wells in Berar varies from 20 to 90 feet, the average depth being from 30 to 40 feet. The supply is as a rule from percolation, but often good springs are met with. In ordinary years these wells hold sufficient water for drinking purposes; but, during the seven years preceding 1900, the spring water level went down considerably, and a large number of wells ran dry in the summer of 1900. Many of the deeper wells are situated on the alluvial tracts extending for a distance of 15 to 20 miles on either side of the river Purna.

The majority of the shallow wells if sunk to an average depth of 100 feet are sure to yield sufficient water for irrigating about 5 to 7 acres of land for rabi crops in an ordinary year, and 3 to 5 in a year of drought.

Good potable water is obtained throughout Berar, except in about 400 square miles to the north and south of Akola.

The average cost of wells as constructed in Berar is from Rs. 10 to Rs. 15 per foot depth and they vary from 6 to 10 feet in diameter. The yield of water increases in proportion to the quantity of water drawn and the regularity with which it is drawn, on account of the substrata being favourable, the water-bearing interstices, which are either of carbonate of lime, or of deteriorated trap crust, getting readily washed out by the passage of water.

Wells in use are not known to have failed through the water-bearing interstices getting choked up.

Temporary wells, or zeeras, are very commonly excavated in beds of streams and serve well for drinking purposes in a year of drought, or at the end of hot weather in ordinary years.

A careful selection of likely sites for good wells should be made prior to a year of scarcity, and a record of such sites kept; and should occasion arise for their construction in a year of scanty rainfall, they can at once be undertaken.

The reason why large tanks could not be undertaken during the last famine was that not sufficient water-supply was available at site of bund, or close by, for famine labourers and for puddle work. It would, therefore, be very desirable either from a protective famine grant, or from Provincial money to set apart a sum of Rs. 10,000 to Rs. 20,000 to extend over such a time as would be required to sink tubular wells at sites of proposed storage tanks. Such tubular wells would probably have to be sunk to a depth varying from 100 to 200 feet and would give ample water in ordinary times for rabi, or dry crop irrigation for 20 or more acres, and would be most useful for constructing tanks during famine times for irrigation purposes.

Strata in wells.—In the Purna valley the strata generally consists of very deep black alluvial soil, overlying a strata of yellow clay and lime mixed with kunker nodules and pebbles up to a depth varying from 30 to 70 feet, and below this yellow clay is often found red clay, overlying a layer of coarse and fine gravel up to 100 to 130 feet in depth.

General strata of wells excavated in Berar, except the valley of the Purna.

Alluvial or yellow or reddish soil varying from 5 to 8 feet in thickness.
Soft muram varying from 10 to 20 feet in thickness.
Hard muram varying from 15 to 30 feet in thickness.
Thin layer trap varying from 8 to 15 feet in thickness.
Blackish or Lydian rock sometimes magnitite rock varying from 7 to 15 feet in thickness.
Trap or gneiss supposed not to exceed 60 to 70 feet in thickness.
Below this is supposed to be limestone strata.

In the Balaghat and other parts of Berar there is thin layer of alluvial or other inferior reddish or yellowish soil formed from deteriorated trap, or muram, which it overlies. Below the deteriorated muram is found hard muram often overlying compact blackish cherty rock, a kind of Lydian stone. This rock is supposed originally to be a silt hardened by outpouring of igneous rock or formed by chemical infiltration. Trap is very often found below this, but also sometimes in thin layers above it. If wells were to be sunk below this lower layer of trap which is of varying thickness not exceeding 60 to 70 feet, it is believed that a layer of limestone would be met with which is a water-bearing strata.

The appendices entered on the following page are attached.

APPENDICES.

I.—Statement showing population, area, and the cultivated area of each district of Berar.

II.—Statement showing percentages of culturable, cropped and uncultivated areas, and forest, to total area.

III.—Statement of average rainfall, month by month, by divisions for ten years from 1891 to 1900.

IV.—Statement showing ten years' average rainfall month by month in Berar Divisions.

V.—Statement showing average rainfall, month by month, for the whole of Berar for ten years from 1891 to 1900.

VI.—Statement showing rainfall during monsoon months for ten years from 1891 to 1900.

VII.—Statement showing tanks and reservoirs executed as relief works in Berar during the famine of 1899-1900.

VIII.—Abstract of Famine Programme for Hyderabad Assigned Districts for the year 1901.

IX.—Statement giving statistical information regarding certain large storage works.

X.—Statement showing information as to height of water, rainfall, etc., at the Wadali tank from years 1892 to 1901.

IX.—Statement showing information as to height of water, rainfall, etc., at the Kalapani tank from years 1892 to 1901.

XII.—Statement showing evaporation at the Jenoona tank at Khamgaon.

XIII.—Statement of rainfall for ten years from 1891 to 1900 for the Melghat (Chikalda).

APPENDIX I.

Statement showing population, area and the cultivated area of each district of Berar.

District and Division.	Population.	Area.	Gross cultivable area.	Average cropped area.	AREA IRRIGATED						Percentage of				Remarks.
					In a normal year			In a year of drought							
					by State Irrigation Works.	by Public Works Department and L. F. tanks and wells.	by wells.	by State Irrigation Works.	by Public Works Department and L. F. tanks.	by wells.	5 to 4	7 to 5	8 to 5	4 to 3.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Sq. miles acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.	Sq. miles. acres.					
East Berar Division.															
Amraoti District	*228 630,118	2,759 1,765,896	2,321 1,485,377	2,321 1,485,257	... ...	... ...	15 9,528	... ...	... ...	... ...	99·99	...	0·61	84·11	
Ellichpur District	*114 297,403	2,617 1,674,808	1,050 671,840	*993 635,594	... ...	... ...	4½ 2,980	... ...	... ...	... ...	94·60	...	0·46	40·11	
Wun District	*119 466,929	3,921 2,509,337	2,762 1,767,097	2,513 1,608,137	... ...	... ...	3½ 2,237	... ...	... ...	... ...	90·41	...	0·14	76·44	
Total	*150 1,394,450	9,297 5,950,041	6,133 3,924,314	5,827 3,728,988	... ...	... ...	23 14,745	... ...	... ...	... ...	95·01	...	0 31	65·96	
West Berar Division.															
Akola District	*217 582,540	2,670 1,714,486	2,241 1,434,090	2,232 1,428,200	... ...	10 6,611	... ...	... ...	... ...	... ...	99·59	0·46	...	88·64	
Buldana District	*151 423,616	2,809 1,797,902	2,228 1,425,811	2,218 1,419,532	... ...	55 35,239	... ...	... ...	... ...	... ...	99·56	2·48	...	79·34	
Basim District	*119 353,410	2,959 1,893,505	2,025 1,296,405	1,986 1,271,106	... ...	5 3,152	... ...	... ...	... ...	.. ...	98·13	0·24	...	68·46	
Total	*161 1,359,566	8,447 5,405,873	6,494 4,156,306	6,436 4,118,841	... ...	70 45,035	... ...	... ...	... ...	... ...	99·09	1·09	...	76·88	
GRAND TOTAL	*155 2,754,016	17,744 11,356,914	12,627 8,081,220	12,263 7,847,832	... ...	70 45,035	23 14,745	... ...	... ...	... ...	97·11	1·09	0·31	71·16	

* These figures indicate the population per square mile.

APPENDIX II.

Statement showing percentages of cultivable, cropped and uncultivated areas and forest to total area.

Division and district.	Gross cultivable area.	Average cropped area.	Uncultivated area available for cultivation.	Area not available for cultivation.	Forest.	Total area or total of columns 2, 5, and 6 (or 3, 4, 5 and 6).	Percentages of				
							Column 2 to column 7.	Column 3 to column 7.	Column 4 to column 7.	Column 5 to column 7.	Column 6 to column 7.
1	2	3	4	5	6	7	8	9	10	11	12
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.					
East Berar Division.											
Amraoti District	1,485,377	1,485,257	120	123,999	156,520	1,765,896	84·11	84·10	0·01	7·02	8·87
Ellichpur „	671,840	635,594	36,246	55,212	947,756	1,674,808	40·11	37·95	2·16	3·30	56·59
Wun „	1,767,697	1,608,137	159,560	230,777	510,863	2,509,337	70·44	64·09	6·35	9·20	20·36
	3,924,914	3,728,988	195,926	409,988	1,615,139	5,950,041	65·96	62·67	3·30	6·89	27·14
West Berar Division.											
Akola District	1,434,090	1,428,206	5,884	96,715	183,661	1,714,466	83·64	83·30	0·34	5·65	10·71
Buldana „	1,425,811	1,419,532	6,279	155,141	216,950	1,797,902	79·34	78·99	0·35	8·62	12·04
Basim „	1,296,405	1,271,106	25,299	118,060	479,040	1,893,505	68·46	67·13	1·33	6·24	25·30
Total	4,156,306	4,118,844	37,462	369,916	879,651	5,405,873	76·88	76·19	0·69	6·85	16·27
GRAND TOTAL	8,081,220	7,847,832	233,388	779,904	2,494,790	11,355,914	71·16	69·11	2·06	6·86	21·97

APPENDIX III.

Statement of average rainfall, month by month, by divisions for ten years from 1891 to 1900.

Division and year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1891 East Berar	0·11	0·91	0·26	0·37	0·07	1·68	9·00	5·03	21·51	2·29	...	...	43·63
1891 West „	0·31	1·71	0·03	0·38	0·14	2·53	11·78	5·50	14·39	2·42	...	...	39·51
1892 East Berar	...	0·09	...	...	0·06	5·30	11·16	15·09	8·21	5·79	0·10	0·01	49·64
1892 West „	...	0·09	...	0·01	0·27	9·39	11·81	13·60	14·32	6·01	0·12	0·22	55·14
1893 East Berar	2·29	0·58	5·50	0·09	2·03	5·76	6·89	13·41	1·33	1·02	2·67	...	47·36
1893 West „	1·65	0·35	2·45	0·10	2·28	6·67	1·55	10·26	1·56	2·87	2·09	...	30·24
1894 East Berar	0·20	...	0·25	0·11	0·06	8·23	14·19	3·21	16·84	1·10	1·30	...	42·87
1894 West „	0·03	0·22	0·60	0·13	0·02	6·07	12·19	2·76	9·28	3·01	0·69	...	36·50
1895 East Berar	0·19	0·78	0·26	0·67	0·17	7·93	8·35	6·34	1·46	0·57	0·03	...	26·05
1895 West „	0·04	1·02	0·23	0·20	0·32	1·67	6·28	4·63	6·03	1·10	0·19	...	21·71
1896 East Berar	...	...	0·01	0·05	0·35	6·86	11·37	9·52	0·22	0·02	0·91	0·52	29·83
1896 West „	...	...	0·02	0·02	0·87	5·31	11·00	4·59	0·35	0·03	0·63	0·32	23·34
1897 East Berar	1·04	0·01	0·07	0·15	0·08	2·15	10·59	11·39	7·45	0·91	0·01	...	34·15
1897 West „	0·15	...	0·01	0·10	0·03	1·83	9·29	9·38	6·19	0·57	...	...	28·18
1898 East Berar	...	0·71	0·05	0·27	0·31	0·81	9·71	1·79	5·02	0·47	0·03	...	28·19
1898 West „	...	0·25	0·06	0·21	0·25	5·04	10·33	3·70	6·03	0·28	0·22	...	27·38
1899 East Berar	...	0·29	0·03	1·20	0·71	4·66	2·38	2·05	1·88	0·33	...	...	14·13
1899 West „	...	0·17	0·02	1·36	0·39	4·04	2·31	2·10	1·41	...	...	...	11·80
1900 East Berar	0·08	0·09	0·02	0·26	0·02	3·26	9·48	12·22	9·26	...	...	0·09	34·78
1900 West „	0·00	...	0·03	0·23	0·01	5·57	9·64	9·10	5·83	...	...	...	30·49

APPENDIX IV.

Statement showing ten years' average rainfall, month by month, in Berar Divisions.

Division.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
East Berar . .	0·39	0·35	0·64	0·32	0·48	5·55	9·61	8·38	7·31	1·85	0·54	0·06	35·48
West Berar . .	0·28	0·38	0·35	0·29	0·45	5·03	8·94	6·61	7·02	1·75	0·47	0·05	31·62
Average for whole of Berar.	0·33	0·37	0·49	0·31	0·46	5·29	9·28	7·49	7·17	1·80	0·50	0·06	33·55

APPENDIX V.

Statement showing average rainfall, month by month, for the whole of Berar for ten years from 1891 to 1900.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept..	Oct.	Nov.	Dec.	Total.	Remarks.
1891	0·21	1·31	0·14	0·48	0·10	3·32	10·39	5·26	17·95	2·36	...	...	41·52	Highest average annual rainfall in Berar 52·39 in 1892.
1892	...	0·09	...	...	0·63	6·84	12·99	14·45	11·27	5·90	0 11	0·11	52·39	
1893	2·07	0·47	3·97	0·10	2·15	6·22	5·72	12·18	4·45	3·44	2·63	...	43·40	
1894	0·11	0·11	0·43	0·12	0·05	7·18	13·34	2·98	10·36	4·01	0·99	...	39·68	
1895	0·11	0·90	0·26	0·43	0·25	6·30	7·37	5·18	5·24	1·14	0·21	...	27·39	
1896	...	...	0·01	0·04	0·61	6·18	11·19	7·06	0·28	0·03	0·77	0·42	26·59	
1897	0·74	0·01	0·05	0·13	0·05	2·14	9·94	10·39	6·97	0·74	0·01	...	31·17	
1898	...	0·50	0·05	0·24	0·28	5·92	10 05	4·25	6·00	0·37	0·13	...	27·79	
1899	...	0·23	0·02	1·28	0·55	4·35	2·35	2·53	1·64	0·02	...	...	12·97	Lowest " 12·97 in 1899.
1900	0·08	0·05	0·03	0·21	0·02	4·41	9·56	10 66	7·54	...	...	0·04	32·63	
Average	0·33	0·36	0·50	0·31	0·46	5·29	9·28	7·49	7·17	1·80	0·50	0·06	33·55	

APPENDIX VI.

Statement showing rainfall during monsoon months for ten years from 1891 to 1900.

Years.	Rainfall during monsoon months.							Total.	Remarks.
	May.	June.	July.	August.	Sept.	October.	November.		
1891	0·10	3·32	10·39	5·26	17·95	2·36	...	39 38	
1892	0·63	6·84	12·99	14·45	11·27	5·90	0·11	52·19	
1893	2·15	6·22	5·72	12·18	4·45	3·44	2·63	36·79	
1894	0·05	7·18	13·34	2·98	10·36	4·01	0·99	38·91	
1895	0·25	6·30	7·37	5·18	5·24	1·14	0·21	25·69	
1896	0·61	6·18	11·19	7·06	0·28	0·03	0·77	26·14	
1897	0·05	2·14	9·94	10·39	6·97	0·74	0·01	30·24	
1898	0·28	5·92	10·05	4·25	6·00	0·37	0·13	27·00	
1899	0·55	4·35	2·35	2·53	1·64	0·02	...	11·44	
1900	0·02	4·41	9·56	10·66	7·54	...	...	32·19	
Average	0·46	5·29	9·28	7·49	7·17	1·80	0·50	31·99	

Mr. A. Grant.

30 May 02.

APPENDIX VII.

Statement showing Tanks and Reservoirs executed as Relief Works in Berar during the Famine of 1899-1900.

Division and District	Classification.	Name of work.	Expenditure.	Nature of work.	Utility of work.	Approximate amount required to complete work.	Remarks.
		East Berar Division.	Rs.			Rs.	
Amraoti District.	Construction of storage reservoirs.	Constructing Dhaberi tank reservoir (excavation).	8,654	This is a reservoir in the bed of an existing tank for the water supply of a village.	The work is of permanent utility as it has increased the tank's capacity and will enable the latter to hold water even in dry years which is very necessary.	*Nil*	Practically completed.
Do.	Construction of storage tanks	Constructing Anjangaon Bari tank.	35,565	This is a tank in the Amraoti Hills where water is much wanted for the large number of cattle that are sent there to graze.	This is a work of permanent utility and should be completed.	10,000	This work should be completed when funds are available; but it is doubtful if they will be available for some years to come.
Do.	Construction of storage dams.	Improving Karinja tank.	1,03,391	The work consists in increasing the tank's capacity, reducing its waterspread and increasing its catchment area.	The work is of permanent utility. The tank is a large one, which irrigates a considerable area of land and supplies water for drinking and other purposes to Karinja town.	8,000	The work has been practically completed; only the enlargement of the catchment area remains to be done. The latter should be completed as early as possible, and probably will be during the next year or two as funds become available.
Do.	Do.	Constructing two earthern dams in Wadali tank.	64,573	The work consists in the construction of two tanks in the catchment area of the Wadali tank to hold up the water which usually runs to waste over its weir and to let it into the Wadali Tank as required. It was not practicable to increase the capacity of the Wadali Tank itself, except in the indirect way adopted. The Wadali tank is the source of the water-supply of Amraoti camp and required its capacity increased.	The work is of permanent utility and the capacity of the Wadali tank which required increasing has been considerably added to in an indirect way.	*Nil*	The work has been completed.
Ellichpur District.	Construction of storage reservoirs.	Constructing Ramgarh reservoir.	19,761	These are re-servoirs in the beds of existing tanks for the water-supply of villages.	The works are of permanent utility as they have considerably increased the capacities of the tanks, and will enable the latter to hold water all the year through instead of drying up in the hot weather as they used to do.	*Nil*	The works have been completed.
Do.	Do.	Constructing Galwadi reservoir.	29,031				
Do.	Do.	Constructing Singanwadi reservoir.	30,024				
Do.	Do.	Constructing Bhuran Ramghar reservoir.	34,817				
Do.	Do.	Constructing Kaimpur Samda reservoir.	10,950				
		West Berar Division.					
Akola District.	Constructing of storage reservoir.	Constructing Poonda reservoir.	23,557	There are reservoirs in the beds of existing tanks for the water-supply of villages.	The works are of permanent utility, as they have considerably increased the capacities of the tanks, and will enable the latter to hold water all through the year instead of drying up in the hot season as they used to do.	*Nil*	The works have been practically completed.
Do.	Do.	Constructing Ghusar reservoir.	23,219				
Do.	Do.	Constructing Akotwara reservoir.	34,291				
Do.	Do.	Constructing Kutoosa reservoir.	33,202				
Do.	Do.	Constructing reservoir below bund of Shegaon tank.	11,220	This is a reservoir below dam of Shegaon tank and holds water which filters into it from the tank.	This is a work of permanent utility. The reservoir will be useful for the water-supply of Shegaon town.	*Nil*	Practically completed.
Do.	Constructing storage dams.	Completing tank at Kabsi.	19,377	This is the large reservoir for the water-supply of Akola town and station.	A work of permanent utility. The underground gallery for the supply of water to Akola having failed, the reservoir of tank originally proposed should be made.	1,50,000	This work should be completed as the water-supply of Akola will not be satisfactory till the reservoir is made.
Buldana District.	Constructing storage tanks.	Constructing Rajaora tank.	6,002	These are new tanks for the water-supply of villages, where water is, as a rule, scarce.	These are works of permanent utility and should be completed as soon as funds can be provided for the purpose.	12,000	These works will all be most useful and should be completed as soon as the necessary funds can be provided.
Do.	Do.	Constructing Rolimkheir tank.	16,503			55,000	
Do.	Do.	Constructing Loni Lavalla tank.	9,312			11,000	
Do	Do.	Constructing Motla tank.	30,020			1,35,000	

Statement showing Tanks and Reservoirs executed as Relief Works in Berar during the Famine of 1899-1900—contd.

Division and District.	Classification.	Name of work.	Expenditure.	Nature of work.	Utility of work.	Approximate amount required to complete work.	Remarks.
		West Berar Division—contd.	Rs.			Rs.	
Buldana District.	Constructing storage tanks	Improving Lonar tank.	41,799	These are reservoirs in the beds of existing tanks for the water-supply of villages.	These works are of permanent utility, as they have considerably increased the capacities of the tanks, and will enable the latter to hold out all the year through, instead of drying up in the hot weather as they used to do.	*Nil*	Completed.
Do.	Constructing storage reservoirs.	Constructing Chowdhoni tank reservoir at Sendkheir.	32,365				
Do.	Do.	Constructing Amba tank reservoir at Lonar.	39,184				
Do.	Do.	Constructing Dudi tank reservoir at Mehkar.	19,442				
Basim District.	Construction of storage reservoir.	Constructing Risod reservoir.	70,246	These are reservoirs in beds of existing tanks for the water-supply of villages.	The works are of permanent utility, as they have considerably increased the capacities of the tanks, and will enable the latter to hold water all through the year instead of drying up in the hot weather as they used to do.	*Nil*	Practically completed.
Do.	Do.	Constructing Haralla reservoir.	31,088				
Do.	Constructing storage dams.	Improving Ambona tank.	1,11,252	The work consists in making the existing dam watertight by strengthening and raising it so as to increase the tank's capacity. The tank is a fairly large one and is used for irrigation of fields.	The work is of permanent utility as it will considerably increase the tank's capacity and prevent its running dry as it has occasionally done.	15,000	Most of the work has been done, and the balance should be done as early as possible, as the tank is a most useful one.
Do.	Construction of storage reservoir.	Constructing Wakad reservoir.	28,935	These are reservoirs in the beds of existing tanks for the water-supply of villages.	The works are of permanent utility, as they have considerably increased the capacities of the tanks which was much desired.	*Nil*	Practically completed.
Do.	Do.	Constructing Pardi Agra reservoir.	17,855				
Do.	Do.	Constructing Kali reservoir.	3,303				
Do.	Do.	Constructing Netanse reservoir.	3,435				
Do.	Do.	Constructing Kinhi Raja reservoir.	4,201				
Do.	Do.	Constructing Eklaspur reservoir.	6,503				
Do.	Do.	Constructing Rohaja reservoir.	7,328				
Do.	Do.	Constructing Arsegaon reservoir.	3,174				
		Total .	9,85,000				

Statement showing expenditure on the various kinds of relief works carried out in Berar during the famine of 1899-1900.

District.	Stone metal collection.	Earthwork of new roads and improvement of existing roads.	Water-supply tanks and reservoirs.	Railways earthwork.	Railways stone ballast collection.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Amraoti . { Large works .	5,08,614	59,390	2,07,620	...	...	7,75,533
Amraoti . { Small ,, .	...	...	...	...	...	...
Ellichpur { Large works .	1,27,827	55,703	1,33,595	...	...	3,17,025
Ellichpur { Small ,, .	...	...	...	...	...	...
Wun . { Large works .	2,03,391	...	...	...	...	2,03,391
Wun . { Small ,, .	...	...	...	...	...	...
Akola . { Large works .	11,82,263	...	1,52,124	3,82,501	2,81,629	19,99,517
Akola . { Small ,, .	4,496	31,248	...	..	...	35,744
Buldana . { Large works .	10,54,603	...	1,76,009	4,95,349	99,906	27,26,057
Buldana . { Small ,, .	...	...	...	...	...	...
Basim . { Large works .	9,43,035	3,70,304	2,67,014	1,55,084	37,497	17,73,831
Basim . { Small ,, .	...	30,989	30,322	...	...	67,311
Total .	40,25,329	5,46,594	9,73,683	10,92,913 / 14,50,077	4,18,031	78,97,772

Establishment.	Tools and plant.	Hutting.	Grand total.
+3,74,762	+5,34,653	+4,14,351	=92,21,758

APPENDIX VIII.

Abstract of Famine Programme for Hyderabad Assigned Districts for the year 1901.

Districts.	Stone metal collection for existing roads and for new roads.			Earth-work for new roads and improving existing roads.			Water-supply tanks and reservoirs.			Railways.			Total.			Remarks.
	Estimated cost of project.	Amount available for relief workers.	Number of relief workers for whom employment can be provided for six months.	Estimated cost of project.	Amount available for relief workers.	Number of relief workers for whom employment can be provided for six months.	Estimated cost of project.	Amount available for relief workers.	Number of relief workers for whom employment can be provided for six months.	Estimated cost of project.	Amount available for relief workers.	Number of relief workers for whom employment can be provided for six months.	Estimated cost of project.	Amount available for relief workers.	Number of relief workers for whom employment can be found for six months.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		Rs.	Rs.		
Akola . . .	5,02,719	4,64,358	25,356	72,200	61,971	3,870	2,47,190	1,78,828	10,014	2,08,290	2,77,479	15,415	11,20,729	9,82,639	55,185	The numbers entered in columns 4, 7, 10 and 13 are based on the quantities of work remaining to be done at the close of the last famine and on the quantities of the proposed new works. Provision has been made for many more workers than is actually required.
Buldana . . .	2,89,009	2,69,125	15,027	94,970	94,970	6,941	2,69,310	2,36,700	13,905	3,37,311	3,13,778	17,132	9,81,600	9,14,633	53,305	
Basim . . .	6,79,030	6,36,930	36,198	1,10,065	1,04,627	6,351	2,18,700	2,31,150	13,550	1,74,171	1,62,302	9,016	12,12,269	11,33,009	65,155	
Amraoti . . .	29,52,975	26,57,687	147,633	83,398	75,867	4,126	2,49,615	1,96,521	11,019	...	...	...	32,85,988	29,30,075	162,782	
Ellichpur . . .	28,50,308	25,62,317	141,136	2,85,718	2,59,115	1,396	1,69,900	1,54,900	8,744	...	...	...	33,05,926	29,75,362	164,126	
Wun . . .	32,22,653	28,59,688	160,005	2,23,969	38,300	11,553	86,350	25,200	4,135	...	...	...	35,37,972	29,23,188	176,013	
Total .	1,04,96,724	94,49,105	526,460	8,75,320	6,33,883	46,767	12,62,365	10,26,359	61,776	8,10,075	7,53,559	41,863	1,31,14,434	1,18,62,906	676,886	
Percentage of above totals to Grand Total.	*78*	*80*	...	*7*	*5½*	...	*9*	*8½*	...	*6*	*6*	...	*100*	*100*	...	
Actual expenditure during Famine of 1899-1900.	...	19,25,328	...	...	5,47,594	...	...	9,73,833	...	...	14,50,977	...	...	78,97,772	Establishment. +374,783	Tools and Plant. +534,853 Hutting. +414,351 Total. = 9,221,758
Percentage of expenditure to Total Expenditure.	...	*53½*	...	...	*6*	...	...	*10½*	...	...	*15½*	...	...	...	*4*	*6* *4½* *100*

APPENDIX IX.

Statement giving statistical information regarding certain large storage works.

No.	Heads of Initial Statistics.	Kalapani tank.	Wadali tank.	Anjangaon Bari tank.	Bhir tank.	Karanja tank.	Remarks.
1	Area and nature of catchment	4·17 square miles of hill sides; soil cotton and muram with loose boulders and scrub.	2 square miles, mostly slope of hill sides; black cotton soil and muram with loose boulders.	3·52 square miles; soil black cotton and muram.	57 acres; rough hill sides.	6·30 square miles; mostly black cotton with a little muram.	
2	Assumed average annual rainfall	33 inches	27 inches	30 inches	35 inches	30 inches	
3	Full supply capacity of tank in million cubic feet	70·9 m. c. ft.	21·5 m. c. ft.	24·5 m. c. ft.	0·95 m. c. ft.	155·8 m. c. ft.	
4	Percentage of capacity on assumed average rainfall	21·1	17·1	10·5	13·1	11·2	
5	Water spread at full supply	6,840,000 s. ft.	2,183,602 s. ft.	30,157,530 s. ft.	103,250 s. ft.	41,317,600 s. ft.	
		Length. Height.	Length. Height.	Length. Height.	Length. Height.	Length.* Height.	* Existing bund = 710; East bund = 3,085; and West bund = 3,420; Total=7,215 feet in length.
6	Maximum height and total length of dam	3,740′ 45·06′	2,792′ 29·6′	815′ 47·67′	320′ 25·45′	7,215′ Main bund 27·00; East „ 14·26; West „ 15·99	
		Dam. Sluice. Waste weir.	Dam. Waste weir.	Dam. Sluice.	Dam. Sluice.	Dam. Tower. Waste weir.	
		Rs. Rs. Rs.	Rs. Rs.	Rs. Rs.	Rs. Rs.	Rs. Rs. Rs.	
7	Cost of dam, sluice and waste weir	1,79,689 8,648 14,374	24,336 8,112	32,446 2,021	25,484 2,495	95,042 3,595 1,267	
8	Compensation for land submerged by tank	Rs. 6,960	Rs. 2,775	*Nil*	*Nil*	*Nil.*	
						East and West channels. Supply channels.	
9	Cost of canal and distributing channels	„ 8,329 †	„ 41,210 †	*Nil*	*Nil*	Rs. 2,637 Rs. 5,300	
10	Total Capital cost	„ 2,66,632	„ 1,43,277	Rs. 34,601	Rs. 27,980	Rs. 1,08,391	

† Kalapani and Wadali being town water-supply tanks and not irrigation tanks, the cost of mains and distribution pipes has been shown in this statement.

Mr. A. Grant.

30 May 02.

APPENDIX X.

Statement showing information as to height of water, rainfall, etc., at the Wadali tank from years 1892 to 1901.

Year.	Height of water. Lowest.	Height of water. Highest.	Rainfall during period between lowest and greatest height of water.	Rainfall during year.	Flow of water in million c. ft.	Remarks.
1892	16	26	40·32	45·25	17½	Drainage area 2 square miles.
1893	17	25¾	24·72	35·18	12	
1894	16	26	23·12	29·35	13¼	
1895	15	18¼	15·98	23·56	3¼	
1896	7	26	29·71	32·20	16½	
1897	12½	19	14·55	23·15	5¼	
1898	8⅝	9⅛	4·57	21·00	...	
1899	...	...	...	12·75	...	
1900	17½	21¼	8·58	27·29	4⅜	
1901	7	24¾	14·83	26·38	15	
Average	...	...	19·43	27·61		

APPENDIX XI.

Statement showing information as to height of water, rainfall, etc., at the Kalapani tank from years 1892 to 1901.

Year.	Height of water. Lowest.	Height of water. Highest.	Rainfall during period between lowest and greatest height of water.	Rainfall during the year.	Flow of water in tank in million c. ft.	Remarks.
1892	28½	34	34·17	42·46	22¾	Drainage area 2 square miles.
1893	29¼	30½	13·59	32·51	8½	
1894	20¼	32⅝	23·02	37·29	34⅜	
1895	21¼	21½	4·74	26·77	⅛	
1896	23½	31	20·78	35·43	23½	
1897	16½	17½	20·47	35·23	8	
1898	...	...	...	25·07	...	Drainage area 4·17 square miles.
1899	..	...	...	11·36	...	
1900	23	24½	8·55	31·29	3¼	
1901	15	33½	19·23	30·72	43½	
Average	...	...	18·07	30·81		

APPENDIX XII.

Statement showing evaporation at the Jenoona Tank at Khamgaon from actual observations taken for four consecutive years.

Months.	1882-83.	1883-84.	1884-85.	1885-86.	Average.
June	11·70	6·47	11·82	10 90	10 22
July	6·70	6 23	6·61	7·26	6·70
August	12·55	9·94	8·47	6·09	9·26
September	7 65	4·15	7·14	6·90	6·46
October	10·70	5·75	9·05	6·70	8·05
November	5·75	8·90	8·20	8·48	7·73
December	5·30	6·20	7·75	6·65	6·48
January	5·71	6·20	8·50	7·00	6·85
February	5·70	6·45	7·90	5·60	6·41
March	11·30	8·75	9·30	8·30	9·41
April	13·20	12·10	9·70	11·67	11·67
May	15·55	15·50	15·50	15·52	15·52
Total	111·81	94·64	109·94	101·10	104·36
or	9'—4"	7'—11"	9'—2"	8'—5"	8'—8"

APPENDIX XIII.

Statement of rainfall, month by month, for ten years from 1891 to 1900 for the Melghat (Chikalda).

Year.	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1891 . .	...	2·39	0·37	0·09	0·01	1·07	18·59	11·95	24·80	2·23	...	...	61·50
1892 . .	...	...	...	...	0·77	4·86	17 17	24·71	5·00	8 70	0·58	0·10	61·89
1893 . .	3 26	0·38	4·11	...	5·36	9·17	12·27	23·10	13·18	2·34	2·82	...	75·99
1894 . .	0 37	...	0 64	0·22	0 21	11·59	28·13	10 74	1·81	10 34	1·40	...	78·45
1895 . .	0·15	0·88	0·48	0·84	0·03	10·89	13·92	15·56	6·50	1·08	0·01	...	50·34
1896 . .	...	...	0 05	0·06	0·79	9·41	23·09	23·92	0·28	...	0·24	0·88	58·72
1897 . .	1·49	...	...	0·22	...	4·69	15 98	27·75	10·82	0·27	...	...	61·22
1898 . .	...	0·50	0·07	0·45	0 36	7 30	17 06	19 57	10 42	1·70	...	...	57·43
1899 . .	...	0·02	...	1·53	2·65	5·67	8 93	2 70	2 47	...	...	...	23·97
1900 . .	0·23	...	...	0·04	0·02	4·91	22·42	25·79	24·15	...	...	0·04	77 60
Average .	0·55	0·42	0·57	0·34	1·02	6·96	17·76	18·58	11·24	2·67	0·50	0·10	60·71

1. Q. (*The President.*)—How long have you been in this Province?—Five years.

2. Q. You have been through both famines?—I was through part of the last famine.

3. Q. And where were you before?—I had been in the Punjab, Assam and Burma.

4. Q. As regards the programme for works, I understand you to say that it would be desirable to put in tank bunds in place of stone metal?—Yes, if they make a feeder railway you would not want stone metal.

5. Q. How often do you send in these statements?—Once a year.

6. Q. I suppose you are not expected to send in one that you don't approve of?—No; the one prepared is not a fresh one, it was made out last year; we have had no time to make out a new one.

7. Q. It goes to the Government of India?—Yes.

8. Q. When is a fresh one due?—I think in three months' time; to make out a fresh one of new projects we would require some time; we have no establishment to do it.

9. Q. In the circumstances don't you think it would be right to tell Resident that you are not satisfied with the programme and cannot submit one. You say the thing is not satisfactory?—Yes, I think there is too much road-metalling.

10. Q. If you send it in without any remark it is assumed that you are satisfied with it. Don't you think it would be better to send it in with the remark that it is not what you think right but you cannot make out a better?—We could not send one in time on account of these irrigation tanks being lately thought of.

11. Q. I suppose your work has not brought you in contact with this vexed question of black cotton soil?—No, not very much.

12. Q. Have you ever examined the rivers at all critically?—No.

13. Q. You must cross them at various points?—Yes.

14. Q. Is there any likelihood of being able to dam up any of the bigger rivers so as to irrigate from them?—No, they are too deep; 50 to 75 feet below the banks; the Purna is the only perennial stream and that has not much water in the dry weather.

15. Q. Do you happen to know what is the maximum depth of wells which it pays a man to work from?—Fifty feet.

16. Q. Do you often see wells falling out of repair. We had some evidence that in ten or fifteen years they would come to grief?—I don't think so.

17. Q. You say in your note "the reason why large tanks could not be undertaken during the last famine was that not sufficient water-supply was available at site of bund, or close by, for famine labourers." Couldn't one dig a few *kachcha* wells?—They were dug but they did not contain sufficient water.

18. Q. Not even in the beds of streams?—Most of them were in the beds of streams.

19. Q. You have sent in a notice of four works for improving tanks (position and other particulars explained on map). Do you think they should be finished or would you wait for another famine?—The Karinja, Anjangaon Bari tanks should be finished.

20. Q. (*Mr. Higham.*)—How many sites are there on the map of possible reservoirs?—Seventeen.

21. Q. Have all been put down after examination?—They have only just been put down in the map.

22. Q. Not one site has been examined?—No, there were sites proposed by Mr. Higgins.

23. Q. Had he any personal knowledge of them?—He has been a long time in Berar.

24. Q. Do you anticipate there will be difficulty if you started bunds as relief works in finding water for relief labourers?—Yes, there would be.

25. Q. Have these streams water all the year round?—No, they dry up, the Purna is the only river that is perennial.

26. Q. How would you get more water?—By making tubular wells.

27. Q. How far down would they go?—One hundred to 150 feet.

28. Q. How many of these wells are required for a camp of 10,000 people?—I think one or two wells would be enough; you would have to get into the lime stone strata.

29. Q. Is there any other way of supplying them with water besides that?—No.

30. Q. (*The President.*)—Would an ordinary well not do the business?—You could not get down deep enough.

31. Q. (*Mr. Higham.*)—If you settled you are going to make a bund in a certain place there is no reason why wells should not be made now?—It would be very expensive to do it.

32. Q. Have you estimated the cost?—No.

33. Q. Would you have the sites examined?—Yes, I think so.

34. Q. Could you do that with your establishment?—One or two we could; it would be better to have a special establishment.

35. Q. As far as I understand it, these sites have not been examined?—No; they are only filled in from the topographical map.

36. Q. Of course you would have to find out what the bed is like?—Yes, it is generally rocky.

37. Q. Then you have to consider what materials you require?—Yes, concrete or masonry.

38. Q. I think it was proposed to make earthen bunds?—Yes, there are banks 40 to 50 feet high.

39. Q. In many of these places you would have nothing but rock and rotten *muram*?—There is black soil not far from the surface.

40. Q. Have you ever considered this question of making *bunds* in some of the streams?—No, we have not done that. I have seen it done here on a small scale, they seem to be making more than they used to do a few years ago; people are making them themselves.

41. Q. How high do they make them?—5 to 8 feet high.

42. Q. If you put in a masonry bar and shutters, would not that save trouble?—They have not done it.

43. Q. Might that not be done in some places?—Yes.

44. Q. Why are they not made?—Because they generally silt up.

45. Q. Does not the silt clear off when the puddle gets washed away?—I have not seen many here.

46. Q. If they made a low bar with shutters, there would be no silting up?—These rivers are a great depth below the banks.

47. Q. Are they all low?—No, not all.

48. Q. In the upper parts?—It could be done in the upper parts.

49. Q. Is there possibility of developing that where the beds are not too deep?—It might be done.

TWENTY-THIRD DAY.

(Of sitting in 1902.)

Gwalior, 10th December 1902.

Munshi Ram Prasad.

10 Dec. 02.

WITNESS No. 53.—MUNSHI RAM PRASAD, Revenue Official, Orcha State, Tikamgarh.

(To the President.)—There was distress in the State in 1895, 1896, and 1899. Religious scruples are no obstacle to construction of irrigation works, but there is much black soil in Tehrauli pargana, east of Orcha town. In the State there are about 505 tanks, of which 153 do irrigation direct, and their beds are also sown. In 176 tanks the beds only are sown; while 176 tanks are for cattle only. The areas shown under private tanks include both tank and well irrigation, and is chiefly the latter. There are now more irrigation works than there were before the famine; we are therefore better able to stand a famine. Some of Captain Ewbank's proposed works have been carried out. The new works made since the famine are the Ram Partab Sagar in Orcha and some other tanks; and canals from *jhils* have been repaired. *Bandhias* made in *mar* soil. Mr. Forbes had about 15 or 16 made in the famine; they submerged about 25 acres each and doubled the outturn. They were not more than 6 feet high. The new works made before and since the famine will increase the irrigation 50 per cent. The works will, it is estimated, pay 7 per cent. on the whole. Wells are being made by zamindars and tenants. The rates per *bigha* are—

	Rankar.	Parwa.	Mar.
	Rs. A. P.	Rs. A. P.	Rs. A. P.
Dry . . .	0 8 0	0 12 0	2 8 0
Wet . . .	1 4 0	1 8 0	—

No enhancement is made for three years and in case of famine for five years. The State gives Rs. 5 *inam* and wood free. It has plenty of money for irrigation works. Remission of wet rate is given for five years. After a well has been made after five years have elapsed, the amount of *takavi* is recovered in five years more. Rent is collected in cash. Six per cent. interest is taken on loans.

Munshi Gopi Nath.

10 Dec. 02.

WITNESS No. 54.—MUNSHI GOPI NATH, Dewan of Bijawar.

1. *Q.* (*The President.*)—Your irrigation in Bijawar is chiefly from wells, I gather?—Yes. We have got about 6,000 wells in our State, and certainly most of our irrigation is from wells. Although we have about 20 tanks in our State, nevertheless most of our irrigation is from wells.

2. *Q.* I see from this statement that altogether you have got about two-and a-half lakhs of acres of unculturable land, and that about 12,000 acres are irrigated from wells?—Yes.

3. *Q.* And that this area is irrigated from 6,400 wells, *kacheha* and *pakka*?—Yes.

4. *Q.* That is only two acres per well?—It is only 6 *bighas* to a well on an average, which means 3 acres to a well.

5. *Q.* You have got no private tanks, I suppose?—Hardly any which come under that category.

6. *Q.* Did your State suffer much in the last famine?—Yes. I joined the State only four months ago, so I cannot say positively how much it had suffered, but it has suffered. In my travelling I have found many villages abandoned, and so I infer it has suffered.

7. *Q.* Do you think the State is in a better condition now to withstand famine. If a drought were to come again, would it suffer less than it did in the last famine, or just the same?—I may tell you that the State has been in debt for some time. It was a rather mismanaged State formerly, and has been under the management of the Political Agent for the last three years. It is now emerging from this state, and within the next two years it will have paid all its loans and will be in a fair way to spend money on further improvements.

8. *Q.* Did Captain Ewbank visit that State?—Yes. I learned from the report that he has been there and has made suggestions for certain projects. I don't think the State cares for some of his projects. We generally prefer to carry out works which may cost less and be more useful. I have seen the sites, and, with great deference to Captain Ewbank, I should say they are not sites which the State can take up. Some of the sites won't cost less than a lakh of rupees, which comes to nearly half a year's revenue of the State.

9. *Q.* (*Mr. Muir-Mackenzie.*)—None of those projects cost a lakh of rupees. The cost of the three projects comes to Rs. 62,000?—Even that is more than half a lakh of rupees, which the State cannot afford to pay. We want sites where there are rocks on either side and where a little *bund* might be built up which might cost as little as possible and give us a good deal of irrigation behind. According to Native State calculation, of course, we don't approve of these sites of Captain Ewbank.

10. *Q.* (*The President.*)—I suppose the tanks which are referred to in the statement would be dry in a year of drought?—Yes, most of them become dry during the famine season. The most we can expect from any of these tanks would be a little less than one-fourth of the irrigation in a normal year.

11. *Q.* Is it not better, then, to do more for wells?—I am personally of opinion that the wells will be of very great use, and I think they are a very good famine insurance. I think wells and *bunds* constructed in the State will be of very great use; better than even tanks or other irrigation works.

12. *Q.* Are the people eager to make wells?—Our State is under survey, and when our tenants are assured that they will have a certain amount of peace with their land, then they will have a tendency to construct wells. After two years, if I remain in the State, I will try my best to give them as many wells as I can.

13. *Q.* Would it not be better for the Durbar not to tell these people to wait for two years?—They require a certain amount of capital, and they are not in a position to spare money for this purpose just now. After two years they will be in a position, and then only we can give them money, and not otherwise.

14. *Q.* (*Sir Thomas Higham.*)—Do you think this increase of revenue that has been estimated by Captain Ewbank might be relied upon?—Well, Captain Ewbank is in every way an expert irrigation officer, and I think they must be relied upon in a way. I don't say they cannot be relied upon. I hope they can, provided we can spend which he has estimated.

15. *Q.* You have no irrigation from small tanks in the State; have you?—No. The small tanks are of very small size, and at present are of no use for irrigation.

16. *Q.* (*Mr. Muir-Mackenzie.*)—If Captain Ewbank's estimates that these tanks will pay you about 7 per cent. be correct, would not it be worth the while of the State, even if it has not got money to spend on these tanks, to ask for an advance from the Government of India?—Well, I may inform you that the present tanks are simply made of sand and mud masonry.

17. *Q.* I am asking you about Captain Ewbank's tanks. You say that the objection to the tanks is that they will cost too much, and you also say that Captain Ewbank's estimate of revenue can be relied upon; that is, the tanks will pay you 7 per cent.; would not it be worth your while to borrow money from the Government of India and make these tanks?—It would be a question of years before this 7 per cent. was realized.

18. *Q.* You are afraid, then, that these estimates cannot be realised for a very long time?—Yes.

19. *Q.* Therefore you don't think it would be worth your while to borrow money from the Government of India *for this purpose*?—In case of famine we may borrow money.

20. *Q.* But unless there was famine you would not like to borrow money?—No, not otherwise.

Munshi Gopi Nath.

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21. Q. Would you like any money from the Government of India to enable you to make advances for wells at once?—Yes. Personally I am of opinion that if an amount is advanced to the State, we can better utilize it for wells.

22. Q. You would not be sorry to see some money advanced to the State for wells?—Certainly not.

23. Q. How would you get a return? Would you take an increased revenue?—So long as the State is under Government management, we would follow the same rules as exist in British territory. We would advance the money on the same lines and recover it on the same lines. They have worked fairly well in British territory, and I think they can work well here too.

24. Q. You would prefer to work on British lines, would you?—Yes.

WITNESS No. 55.—PUNDIT JAGAT NARAIN, Kamdar of Baoni State.

Pundit Jagat Narain.

10 Dec. 02.

1. Q. (*The President.*)—You are from the State of Baoni?—Yes.

2. Q. Do you get irrigation from the Betwa Canal?—Yes, we have five State minors from which 520 acres are irrigated at present.

3. Q. What sort of soil is that?—There are four sorts—*mar*, *pundwa*, *rankar*, and *kabar*.

4. Q. Which of these do you irrigate?—We irrigate *pundwa*, *rankar*, and *kabar*; we do not irrigate *mar*, which does not require irrigation.

5. Q. Do you never irrigate it at all; not even in dry years?—Never.

6. Q. You have got cultivated area 31,993 acres and 11,814 culturable waste, and 10,328 acres barren soil. Have you any chance of getting more?—Yes, we can have five thousand acres at least if we are allowed to have more minors constructed.

7. Q. Would you like it if you could get it?—Yes. The question is under consideration. The Government wants to take all these State minors under their control and give the State the cost of these minors, and they promise to construct as many minors as the State would like to take. But this would be profitable to the cultivators and not to the State, because the cultivators could cultivate the possible irrigable area; but as the irrigation fees will be charged by Government, the State won't benefit thereby.

8. Q. Will the State not put on an additional assessment for wet irrigation?—Survey operations are now going on, and if after some time it is proved that the cultivators do derive a good deal of benefit by irrigation, it is possible that the State might raise the revenue on that land, but irrigation fees will go to Government.

9. Q. Is it not certain that the irrigated land will be required to pay a greater tax than unirrigated land?—Afterwards it might, but if a ten years' settlement is made, we cannot increase the assessment made by the Settlement Officer.

10. Have you made any proposal to the Government about this?—The matter is under consideration.

11. Q. (*Sir Thomas Higham.*)—It won't do any harm to the State?—No; but if the State is allowed to construct its own minors, that will be profitable to the State as well as to the cultivators.

12. Q. (*The President.*)—Do you think the State would get the whole of the rent in that way?—Yes, and it will have to pay the cost of water received from the Betwa Canal.

13. Q. How do you do it now?—We have to pay the cost of water received, which amounts to Rs. 1,000 or so every year.

14. Q. Is it regulated according to the area irrigated?—Not according to the area irrigated, but according to the quantity of water received. They have nothing to do with the area irrigated.

15. Q. How is it measured?—It is measured in the presence of the State Munsarim or Sub-overseer or the Sub-Divisional Officer of the Canal.

16. Q. (*Sir Thomas Higham.*)—Do they charge in that way now for the water which is taken?—Yes.

17. Q. (*The President.*)—You have got a great deal of land that will not be covered by the Betwa Canal?—The Betwa Canal runs in almost every direction of this State.

18. Q. You have got 31,000 acres and only take into account about 5,000 acres?—Because the State is in debt, and it cannot spare so much money as to construct minors all at once.

19. Q. And also I think the Canal Department would tell you that they have not enough water in the canal?—We only get water in the *rabi*, but get no water in the *kharif*.

20. Q. There is no water in the *kharif* to give?—But now they are increasing the supply at Paricha.

21. Q. Would you like to have water, say, from the time the monsoons begin, and after that? I don't think they will give you much water during the dry season. They might give you water from the time the floods begin. Would you take water then?—Yes.

22. Q. Do you grow much rice in your State?—At present we don't, because we have not got sufficient water to irrigate.

23. Q. In a normal year the rains begin about the 20th of June or the 1st of July, and it is after that you are likely to get water from the Betwa Canal. Would you take it then?—Yes, we will.

24. Q. How would the people get their rice sown if there was no water before the rains fell?—There is very little rice sown at present. If they can get water then they will sow it.

25. Q. Supposing they don't get any water until July, would you postpone the sowings of rice until then?—Until September.

26. Q. Until the floods begin there is water in the Betwa. You would have to wait until the floods begin. Say the floods begin about the 20th of June or the 1st July, could you sow rice then?—Ye-.

27. Q It would not be too late?—No.

28. Q. The Canal Department could give you plenty of water after that, if the rains failed; but if the rains don't fail you would not require water?—No. We get nearly 30 or 40 inches of rain on an average every year.

29. Q. And for the *rabi* you would take as much water as you could pay for?—Yes.

30. Q. The State is now being settled?—Yes, we shall have the operation from early next year—from July next.

31. Q. Are the different zamindars or *kashtkars* anxious to make wells?—It is very difficult for them, because the water is 30 to 75 feet deep, and it costs Rs. 400 at least for one well which can then irrigate nearly 25 *ighas* or ten acres, and besides it is a *beswardari* right,—it does not belong to the cultivators.

32. Q. What does it cost to make a *pakka* well?—Rs. 400.

33. Q. Do the zamindars do it?—At present they are not inclined, because they have not sufficient money, and as they have not got the *beswardari* right, no *takavi* advances are made to them.

34. Q. The zamindars, you mean?—They are not zamindars; they only get collection charges on the amount of revenue paid by them. The *beswardari* right belongs to the State.

35. Q. Have these men no fixity of tenure?—At present they have not, but in the settlement that is being made that will be done.

36. Q. They are going to get some fixity of tenure?—Yes.

37. Q. According to this statement there are only 54 wells in the State?—Yes. These wells irrigate a few acres of land in which vegetables are sown.

38. Q. (*Sir Thomas Higham.*)—I suppose the Rs. 13,000 that has been expended on State works has been spent on the five minors of the Betwa Canal?—Yes.

39. Q. Not on anything else?—No.

40. Q. Has all been spent on the Betwa Canal minors?—Yes.

41. 20 When were they made?—In 1895.

42. Q. Then you pay so much a year for the water you receive?—We pay nearly a thousand rupees for the water every year.

43. *Q.* Is the bill made out every half-year?—We get a bill in the month of April or May.

44. *Q.* For the whole year?—Yes, only one crop is irrigated,—the *rabi* crop.

45. *Q.* So much a thousand feet is it, or how do they charge?—The discharge is taken every week or fortnight by the Sub-Divisional Officer, and they make out their bill according to their own calculations, and that bill is received from the Political Agent and the amount is paid.

46. *Q.* Is not there a fixed rate per million cubic feet?—I cannot say anything about that.

47. *Q.* You don't know what the rate is?—No.

48. *Q.* Do you make a profit out of it?—Yes. Last year we obtained 10 per cent. as net profit.

49. *Q.* Ten per cent. on your Rs. 13,000?—Yes.

50. *Q.* Every year you make a profit?—Before that we were losing, though that was not the fault of the zamindars or of the Betwa Canal officers, but owing to mismanagement.

51. *Q.* What rates do you charge the people? Do you charge the same water rates as British villagers are charged?—Yes.

52. *Q.* I suppose the real reason for that arrangement is that you don't want the British *patwaris* to measure up the irrigation in your villages?—Before this there was no survey made nor any maps prepared, but the State had their own *khasras*, and they are not at all reliable. Now that a survey has been made, we have just the same figures as those which are charged in the surrounding districts of Cawnpore, Hamirpur, and Jalaun.

53. *Q.* The area is measured up by the State *patwaris*?—Yes.

54. *Q.* The Canal *patwaris* have nothing to do with these minors?—Certainly not.

55. *Q.* Are there any other works that can be done in the State for extending irrigation?—Only these minors can be constructed; otherwise there are no good tanks. There are tanks in almost every village, but they are used for cattle drinking, and most of them receive water in the month of April from the Betwa Canal.

56. *Q.* That is out of the water supplied to the State?—Yes.

57. *Q.* Do you make any charge for that?—No.

58. *Q.* You fill the tanks free?—Yes.

59. *Q.* Then you have to pay for the water?—Yes, we have to pay for the water.

60. *Q.* Are there more minors to be made?—One minor will be constructed this year. That will irrigate nearly 300 acres. We have made an advance of Rs. 985, and we will have to pay some Rs. 1,100 more.

61. *Q.* Where are your minors,—near the bend of the canal, or on the Kathound Branch?—On the Hamirpur Branch.

62. *Q.* Your black soil is there?—*Mar* is not irrigated; only the *pundwa* and *rankar*.

63. *Q.* You say they will cultivate rice if they can get water?—Yes, if the Canal Officers agree to that.

64. *Q.* You mean the canal is not opened?—We have not got a sufficient number of minors at present. Only 12 villages at present irrigated, and we have got 52 villages in all, so that 40 villages get no irrigation at all.

65. *Q.* Why don't they cultivate rice in the villages that do get irrigation?—We get water only for the *rabi* crops in the months of October, November, and December. We don't receive water in the month of July or August.

66. *Q.* If they ran water then you would take it for rice?—Yes.

67. *Q.* You mean to say they don't run water in these months?—They don't.

68. *Q.* That is because they say nobody wants it?—If they can give water, we are ready to take it.

69. *Q.* (*Mr. Muir-Mackenzie.*)—You say you pay about a thousand rupees a year for the water you receive, don't you?—Yes.

70. *Q.* And your expenditure was Rs. 13,000, was not it?—Yes. *Pundit Jagat Narain.* 10 Dec. 02.

71. *Q.* And you said you made a profit of 10 per cent., that is, Rs. 1,300. Therefore in the year that you made 10 per cent., you had to pay Rs. 2,300, and you irrigated 520 acres. That means you charged more than Rs. 4 an acre?—If these 520 acres of land were to be measured according to the measurement of our *bighas*, it will be found that they are no less than four times as great as the English surrounding districts.

72. *Q.* How many English acres did you irrigate?—Nearly 1,200 or 1,300 acres.

73. *Q.* You say, if you got water as early as the beginning of July or the end of June, you could irrigate rice?—Yes.

74. *Q.* Have you ever asked for water at that time of the year?—For so long the cultivators were very much afraid of that, but when they get a good experience of the surrounding villages which have been irrigated for the last few years, and have become wealthy in consequence, they will follow their example.

75. *Q.* But these surrounding villages have not taken water for rice yet?—No, they have not. No water has yet been given to the *kharif* sowings either in British territory or in the Native States.

76. *Q.* If you can get rice by sowing it so late as July, why don't you sow it on the strength of the rain water? You always get rain in the end of June and beginning of July?—But sometimes there is a failure of rain in September, and, besides, there are no minors at present in the villages in which rice may be sown.

77. *Q.* You say you have not taken any water yet for *mar* soil?—No.

78. *Q.* We found in Government villages in the last few years, beginning with the famine year of 1896-97, that people have taken water in *mar* soil?—We have not taken any.

79. *Q.* What is the difference between the villages in which rice can be grown, and those in which rice cannot be grown?—Rice is cultivated in our villages mostly in *purwa* soil. There are two or three villages with a few *bighas* of land in which rice is sown of Haunsa, Kharonj, and Gohna.

80. *Q.* Are those lands under tanks?—There are no tanks.

81. *Q.* Where do they get their water for the rice?—There are *bunds*.

82. *Q.* How early do they sow that rice?—They sow it early in July.

83. *Q.* What is the name of the variety of the rice?—That I cannot say. It is the common rice which is sold at eight seers for the rupee.

84. *Q.* Is it transplanted rice or broadcast rice? Do they cultivate it by broadcast sowing, or do they transplant it?—They don't transplant it; it is simply broadcast.

85. *Q.* You don't think rice can be grown successfully in *mar* soil?—We have had no experience of that for the present.

86. *Q.* Do the people make many of these *bunds*?—Yes, small *bunds*, not very high ones.

87. *Q.* Have you ever advanced them any money for that?—During the famine we made an advance of Rs. 10,000 or so.

88. *Q.* For making *bunds*?—Yes. We make advances for bullocks and seed, etc., every year to the extent of Rs. 5,000 or 6,000.

89. *Q.* Do they use these *bunds* for killing *kans*?—A separate advance of Rs. 10,000 was made for killing *kans*.

90. *Q.* By means of *bunds*?—No.

91. *Q.* Are the *bunds* ever made in your State for flooding *kans* and so killing it?—No, very high *bunds* are not made.

92. *Q.* (*The President.*)—How do they kill the *kans* with these advances?—Sometimes they burn it, sometimes they dig it.

WITNESS No. 56.—BABU KASHI PERSHAD, of Chattarpur.

Babu Kashi Pershad. 10 Dec. 02.

Q. (*The President.*)—You have got a cultivable area of 163,000 acres?—Yes.

1. *Q.* And you have got 1,466 acres normally irrigated by Government works; what are these tanks?—By tank canal irrigation, by *bund* system of irrigation, and by wells.

Babu Kashi Pershad.

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2. *Q.* Are these all State works?—Yes, only 253 acres of land are irrigated by tank canals. There are three irrigation tanks in the State.

3. *Q.* What is this 1,466 acres? Is this by State wells?—Yes, by tank canal irrigation, by *bund* system of irrigation, and by wells.

4. *Q.* Wells belonging to the State?—Yes.

5. *Q.* And is the State in the habit of building wells?—Wells are built by cultivators generally.

6. *Q.* And some are built by the State?—Yes, and then there are wells which have been left to the State by persons.

7. *Q.* You have from 31,000 to 36,000 acres irrigated by wells?—Yes; these are all built by cultivators.

8. *Q.* Are they anxious to make more wells?—Yes, they are anxious to make wells, and they are in the habit of making wells.

9. *Q.* Is *takavi* advanced to them?—Yes, and Rs. 15 is also given to them as a prize for making wells.

10. *Q.* How much does a *pakka* well cost?—Rs. 80.

11. *Q.* You have not got very far to go for the water?—No, only 30 feet.

12. *Q.* Is Chattarpur in the country where the new canal is to come? Do you know the new canal which the Government of the United Provinces propose to make?—No, there is no canal.

13. *Q.* But it is proposed to make one from the new?—I have not heard anything about it. Later on I came to know that a new canal is proposed to be constructed from Baeyarpur on the Kain in Ajaigarh territory.

14. *Q.* What do you think is the best means of protecting your country from famine?—By digging wells and by constructing tanks where possible. Wells are more suitable for the country than anything else.

15. *Q.* Have you got hopes that the well irrigation will largely increase? There is only about 30,000 to 36,000 acres now out of 168,000 acres of cultivable land. It is only about 20 per cent.?—That is according to the population of the cultivators.

16. *Q.* If you depend upon wells, then you would like to do much more than that. If you have no other means of irrigation, you would like to increase the number of your wells?—Yes, we are increasing them annually.

17. *Q.* How many wells have you got about?—About 8,836 *pakka* wells and about 1,825 *kachcha* wells.

18. *Q.* How much does one well irrigate?—One well irrigates about eight *bighas*.

19. *Q.* How many acres is that?—About three acres.

20. *Q.* (*Mr. Muir-Mackenzie.*)—You want more wells, don't you? Do you think you have enough for the country?—We don't want more wells; when we require wells they are dug annually.

21. *Q.* If you had famine coming on again now, your wells would not be sufficient?—In a year of complete drought we can have no water from wells.

22. *Q.* Do the wells run dry?—Yes. In a normal year about 10 per cent. of the wells dry up; and if we have a year of complete drought, we will have about 90 per cent. of wells drying up.

23. *Q.* (*The President.*)—Is there any record in your State of any year in which the wells all ran dry?—No record can be found.

24. *Q.* Why do you think they will all run dry?—In a year of drought in other places wells often go in, and in normal years they dry about 10 per cent., so if there is a year of complete drought, these wells will be dried up. We hear from aged persons that in 1025 there was no rain, and the big tank of Jagat Sagar, which is in Mhow, was altogether dried up.

26. *Q.* We found in other States that the wells burst out; they have water all through the year?—They burst, but the supply of water in them depends on the rainfall.

27. *Q.* Have you any other way, you think, in which you could protect your State from famine?—The only way is by increasing the number of wells and constructing tanks.

28. *Q.* (*Mr. Rajaratna Mudaliar.*)—Would the wells give more supply if deepened?—Yes, they can give more supply. But generally there is hard rock under them, and such wells cannot give more supply; when there is no hard rock they can supply a little more water.

29. *Q.* Is anything done to blast these rocks?—No; where it is too hard it cannot be blasted by any means.

30. *Q.* I suppose boring instruments have been tried?—No.

31. *Q.* Would you like to have boring instruments?—Yes, the State wants to make an experiment with them.

WITNESS No. 57.—PANDURANG BABU RAO, Naib-Dewan, Rutlam State, Central India.

Pandurang Babu Rao.

10 Dec. 02.

1. *Q.* (*The President.*)—Tell us generally about your country. How do you protect it from famine?—There are no other effective means in our opinion to protect our country from famine, except wells. If we can increase the number of wells, then I believe we can do something in that way. The only difficulty is that in the hilly tracts we cannot have good wells, because where we find rock just on the surface almost, it requires a greater amount of money to dig wells

2. *Q.* You say that is the only means. In the hilly tracts could you not make tanks?—The contours of the land are not favourable for making big tanks. They can have only small tanks.

3. *Q.* Could you not make a number of small tanks?—We were looking about in the last famine for sites, but the general contours of the land are not favourable for making even small tanks in the hilly tracts.

4. *Q.* You cannot find even in the hills any places where you could make tanks. That is a pity?—It is not a pity, because these tracts are inhabited mostly by Bhils who are not inclined very much to the better sort of cultivation. They are very indolent, and will not take to cultivation properly. They are the people who feel the pinch of famine first. On the plateau land, however, we would be doing something in the way of protection by having more wells. There we have people who will take kindly to cultivation and irrigation, and, funds forthcoming, we will be able to do something for them.

5. *Q.* The Bhils are almost all in the hill tracts?—Yes.

6. *Q.* What can you do for them?—That is a question which is very hard to solve, and which we would like to have the Irrigation Commission solve for us.

7. *Q.* Were there great difficulties?—Yes.

8. *Q.* In the plain tracts do people make wells?—Yes.

9. *Q.* At what depth do you come to rock?—In some places at 50 feet.

10. *Q.* When you meet with rock do you blast it?—When it is soft it is dug; if it is hard it is blasted.

11. *Q.* We have had a proposition made to us that there should be boring tools to help the people in the matter of wells; do you think that would be a good thing?—I don't think steel boring tools would be of use for hard rock; that would require diamond, drills, which would be very costly; the trap is sometimes 8 to 10 feet thick.

12. *Q.* Is *takavi* given to people for boring wells?—It is not generally given, nor is it applied for; the difficulty is the recovery. Revenue Officers don't generally give *takavi* to cultivators. All wells are owned by the State which has to do everything, even dig and clean them; the number of cultivators is very small; there is a large amount of cultivable land lying waste.

13. *Q.* Did you suffer very much in the famine?—Yes. On account of there having been no famine in the last 50 years the Bhil tract was particularly bad. About 23 per cent. of the population are Bhils.

14. *Q.* (*Sir Thomas Higham.*)—You say that for some years past you have set aside Rs. 10,000 for digging new wells?—Yes, and for cleaning and repairing them.

15. *Q.* When you make a new well that belongs to the State?—Yes.

16. *Q.* You actually make wells for the people?—Yes.

17. *Q.* What return do you get?—A higher rental.

18. *Q.* Does the higher rental pay for making the wells?—Yes, in a very short time it is remunerative.

19. *Q.* It is a good financial investment?—Yes.

20. *Q.* Then why don't you spend more than Rs. 10,000?—The financial condition of the State is not all right; we are in debt.

21. *Q.* If you can get extra revenue on the expenditure, you could afford to borrow the money to extend wells?—Yes, it is an experiment worth trying; the only difficulty is

that in the time of drought the wells would fail, as many did in the last famine, when only 9 per cent. of the ordinary area was irrigated.

22. *Q.* Did you ever try boring down?—Yes, and succeeded in getting water in some places. Where rock was not found we could do nothing; we worked with a crowbar, going down 15 feet.

23. *Q.* What do you assume is the area a well will irrigate?—Five and half acres.

24. *Q.* What extra revenue do you get on that?—We get on every acre about Rs. 21 extra. On irrigated land it is Rs. 12 per *bigha*, and on ordinary land only Rs. 1-8.

25. *Q.* It is a good investment?—Yes.

26. *Q.* What is the cost of a well?—A *pakka* well costs Rs. 600 to Rs. 800.

27. *Q.* You get a very good percentage?—Yes; but want of money and want of cultivators are the obstacles.

28. *Q.* You cannot get cultivators if you put down a well?—Not unless we ask the cultivators in adjoining lands to come and then other lands will lie fallow; all the States in Central India have the same difficulty.

29. *Q.* Where do the people go?—There is a general shortness.

30 *Q.* How much could you spend usefully on making wells if you had the money?—Rs 30,000 would not be a large sum; with expert advice and better tools the thing could be made remunerative.

31. *Q.* Have you ever put down wells and then found there is no water?—Sometimes, especially when there is hard rock.

32. *Q.* You said you also clean out wells; does that cost much?—Not much; about Rs. 10 per well, but the total comes to a good deal. We have a large number of *kachcha* wells, and that means more in cleaning than we can spend.

33. *Q.* You don't think it is any good making tanks?—I don't think so; small tanks might be of some use, but they fail.

34. *Q.* Have *bandharas* been tried?—I don't think they are necessary.

35. *Q.* Why?—Because for the *rabi* crops we have sufficient moisture even if rain is three-fourth of the normal; we don't want irrigation for the *rabi*.

36. *Q.* Do they make channels from existing nullahs to take flood water to the fields?—No, they have pits which are used as wells; these are only used where there is a running flow.

37. *Q.* I suppose you require irrigation only for garden crops?—Yes, that is almost entirely opium in our State.

38. *Q.* If you make new wells and, spend Rs. 30,000, would that be all for opium?—Yes. *Pandurang Babu Rao.*

39. *Q.* You don't want wells for other crops?—Sugarcane to some extent. 10 Dec. 02.

40. *Q.* Is opium a very paying crop?—Yes, it is considered to be paying to the cultivators.

41. *Q.* Could you grow more if you had the means of irrigating it?—Yes.

42. *Q.* Do you grow chillies?—In very few places.

43. *Q.* Do they want water?—Yes.

44. *Q.* (*Mr. Rajaratna Mudaliar.*)—It is said in paragraph 8 of the report "a cultivator who uses his own or borrowed capital in making a well gets one *bigha* of land rent free for every 3 *bighas* of land that he irrigates, and he is charged only for the remaining 2 *bighas* at the ordinary irrigation rate, *i.e.*, Rs. 12-5-7 per *bigha*"?—Yes, that concession is given to the cultivator who uses his own capital or capital borrowed from the State.

45. *Q.* If the rate were reduced, do you think the people would construct wells themselves?—I don't think so; it would be hard to reduce the rates. Again, if you reduce the rental, other cultivators from adjoining lands will flood into the one with a low rental.

46. *Q.* When the wells become useless, do you continue this charge where the rayat makes the well?—I believe they would have to make a remission, but am not certain.

47. *Q.* What rate do you charge if the State constructs wells?—Rs. 11-12-7 per *bigha* on irrigated land.

48. *Q.* No area is exempted?—No.

49. *Q.* (*Mr. Muir-Mackenzie.*)—Did you find your wells actually dried up in the famine?—Many did.

50. *Q.* Have you got figures of the area irrigated?—I have given them in the first paragraph of the report.

51. *Q.* What was the year of drought to which you allude?—1899-1900.

52. *Q.* And in 1896-97 what was it like?—It was simply scarcity.

53. *Q.* Between 1896-97 and 1899-1900 had you years of short rainfall?—No, normal.

54. *Q.* What is the normal rainfall?—Thirty-four inches.

55. *Q.* What was it in 1899-1900?—Fourteen inches, and it was not timely.

56. *Q.* Were there any places where the rainfall was less than 14 inches?—I don't think so.

57. *Q.* What was it in 1896-97?—Thirty inches.

Witness No. 58.—Lala Parmanand, Assistant Dewan of Nagode.

(*To the President.*)—There is practically no irrigation in the State. About 250 acres are irrigated from wells; one well irrigating about one acre. There are many *bandhs*. The people experienced some distress in the famine. The outturn was about 8 annas. About one-fourth of the cultivation or 50,000 acres is protected by *bandhs*, some of which are 20 feet high. *Bandhs* gave protection in the famine. *Lala Parmanand.*

(*To Sir Thomas Higham.*)—Big *bandhs* are made by the State, and *takavi* is given to cultivators for construction of small *bandhs*. (2,500 square yards = 1 *bigha*.) 10 Dec. 02.

Witness No. 59.—Rao Bahadur Balwant Rao, Dewan of Sitamau.

(*To the President.*)—In the famine of 1899 the *rabi* was about 20 per cent. of the normal; there was no *kharif* at all. Some of the wells were deepened down to hard rock; sometimes rock was met at once; the deepening was then stopped. The Chambal is 20 or 25 feet from the ground. Water might be pumped up from it for irrigation. On the Sansi Nadi four *bandhs* and four *bandharas* should be made; they would benefit wells, besides giving direct irrigation. The State has not got enough money; it borrowed 1¾ lakhs from mahajans in famine. It has to pay that back with interest at 7½ per cent. Since the famine year the people have found the wells of great use, and have gone on using them. These are *kachcha* wells, but generally there is rock in them. *Bandhs* are not of much use, as it is all *kharif* country and *bandhs* are not used for *kharif*. Wells are used for irrigation of barley and wheat; half the land is black which can be irrigated. *Rao Bahadur Balwant Rao.* 10 Dec. 02.

Witness No. 60.—Captain F. G. Beville, Political Agent, Bundelkhand.

1. *Q.* (*The President.*)—You are Political Agent in the Bundelkhand States?—Yes.

2. *Q.* How long have you been there?—Two years.

3. *Q.* You have been long enough to know them, pretty well?—Yes, somewhat.

4. *Q.* How many are there?—Twenty-three in all.

5. *Q.* Can you speak of Captain Ewbank's work; was the work he did in estimating for dams, etc., serviceable?—The scheme was drawn up just after the famine of 1897, and after that Captain Ewbank was deputed to the agency to draw up a scheme of protective works, but the works suggested all required a masonry face, and are therefore not suitable as famine works; his estimate of profit is higher *Captain F. G. Beville.* 10 Dec. 02.

Captain F. G. Beville.

10 Dec. 02.

than we can expect; unless we can induce a State to see there is profit in a work, they won't take it up; in the famine they made many works that were of little or no productive value.

6. *Q.* Did Captain Ewbank carry any persuasion with him; was he thought much of in the States?—Yes.

7. *Q.* His schemes are rather protective than relief schemes?—Yes.

8. *Q.* He went in for a stone wall in every case?—Yes, it is not a good work for famine.

9. *Q.* Have any of them been carried out?—No.

10. *Q.* Where is Captain Ewbank; do you know?—I think he is in the Punjab.

11. *Q.* Are the States in a position to carry on any works?—Small works, not big ones; the States suffer from want of professional advice; they are small and cannot afford an expert engineer to look into plans and estimates and select sites; that is one of the great failings we have in the Agency. I think we require an officer for all the States in combination, and not for an individual State.

12. *Q.* Would the States consent?—There is a sufficient number under Government who could do it.

13. *Q.* The Orcha Raja is well disposed towards this; is he not?—Yes, he takes a personal interest in irrigation schemes; one of the difficulties is that he cannot get enough people to take up the ground that he has prepared for irrigation; a large tank was made and the cultivators were offered low rents to take up the land under it, but he has found difficulty in obtaining tenants.

14. *Q.* (*Mr. Muir-Mackenzie.*)—The population is very sparse?—Yes, and there is no fixity of tenure.

15. *Q.* (*The President.*)—Does he say that himself?—Yes, there being no fixity of tenure, the people are very chary of taking up works that they would get no benefit from. In States which Government supervise we are having a cadastral survey made with a view to having fixity of tenure; we have reduced the rate of interest on *takavi* advances to 6 per cent.

16. *Q.* How much *takavi* did you give?—In the Baoni State, with a revenue of a lakh, we gave Rs. 8,000; that is a Mahomeden State and so we charged no interest.

17. *Q.* How do you get your return?—By enhanced revenue. In Bijawar, with a revenue of two lakhs, we gave Rs. 8,000; we would give more, but we don't know if the tenants could apply it usefully.

18. For what is it given?—Wells and plough bullocks and seed grain. A well costs Rs. 60, and in certain tahsils these wells on an average will irrigate 10 acres of lands, and therefore I think it is more economical to have them than tanks.

19. The Betwa Canal only works through the *rabi*; there is practically no water available in the months of May and June, so they could not have an early *kharif*, but there is water available for a late *kharif* if the people would sow rice?—In ordinary years there is not sufficient water in the soil to give you a *rabi* except on certain soils.

20. *Q.* We hoped to find some means of raising rice for which there would be any amount of water towards the middle or end of the rains?—It has not been the custom in the country; I think it is a matter of custom to a great extent, and then the population has decreased during the last decade for want of fixity of tenure.

21. *Q.* I suppose that is due to famine?—Yes, the pressure of demand on the people causes them to leave the country. As we settle the States managed by Government, we hope to increase the revenue of the State, and extend cultivation; to give them better terms and fixity of tenure.

22. *Q.* (*Sir Thomas Higham.*)—Had Captain Ewbank any experience before?—He was in the famine of 1897 in Bundelkhand; he naturally had more experience of the country than an officer who was posted straight away. After the famine of 1897 he was deputed to make these schemes and provide works.

23. *Q.* You don't then want anybody else to prospect for works in Bundelkhand so long as you have that programme?—I think his works are mostly new works; there are existing tanks, which, with a certain amount of repair, would make good productive works; he did not make schemes for these; he mentions them in his report.

24. *Q.* Would the programme of works that he prepared give full employment in the case of such a famine as you had in 1897?—His programme is for 9 per cent. for three months; that is rather short, as the orders of Government are 25 per cent.

25. *Q.* What do the members of the States think of protective works; do they think them good, or would they rather spend the money on something else?—Irrigation and public works are rather neglected in Bundelkhand, with the exception of Orcha, where the Maharaja takes a personal interest in the matter; not much attention is paid to them; it is a question of educating them; the best way is to find works that will give a return for the money spent; then the people will realize the benefits.

26. *Q.* Are religious scruples any obstacle to irrigation, do you think?—That is an excuse put forward, but I heard at Orcha that there was no truth in it.

27. *Q.* Has Captain Ewbank entered field embankments in his report?—He suggested that embankments would be useful.

28. *Q.* He does not say where they should be?—No, he simply makes a suggestion for holding up water.

29. *Q.* Are there any of these now?—There are a few in the higher plateaus of Aljgarh and Panna towards Nagode in Baghelkhand.

30. *Q.* Do they go on making them now?—They repair some embankments every year; what they do is to cut the *bandh*, let out the water, and then repair it.

31. *Q.* Are they making new ones?—No, there is no extension.

32. *Q.* Were any embankments made during the famine?—Yes, by relief labour and *takavi* grants.

33. *Q.* In every State?—No.

34. *Q.* (*Mr. Muir-Mackenzie.*)—They were made by *takavi* grants,—not by relief labour managed by the State?—No.

35. *Q.* (*Sir Thomas Higham.*)—Grants were given to the owners?—Yes, and they employed their own tenants.

36. *Q.* That is only a way of advancing relief?—Yes.

37. *Q.* Did they actually make *bandhs*?—Sometimes they did.

38. *Q.* Should there be supervision?—I think there should certainly be someone to supervise the works that are undertaken; if there had been expert advice, there would not have been the mistake that has been made at Orcha.

39. *Q.* The State people would know as much about soil as an engineer?—Yes; no doubt in this case the Maharaja knew something of the soils; the reason why people would not take up land below the tank from which the Maharaja made ducts was that the soil there was rather poor; if there had been an expert irrigation officer, then this mistake would have been avoided.

40. *Q.* Would not a Revenue Officer know more about the soil than an engineer?—Where is the Revenue Officer; the Maharaja is his own Revenue Officer.

41. *Q.* Are there no natives who know settlement works?—Every native knows the quality of the soil.

42. *Q.* Do you think Captain Ewbank paid any regard to the soils in his works?—No; some of the soils are such as natives never irrigate at all.

43. *Q.* (*Mr. Muir-Mackenzie.*)—In what soil are *bunds*?—Heavy soils for the most part.

44. *Q.* They don't make *bunds* in *mar* soil?—Sometimes it gives them an increased *rabi*.

45. *Q.* Do they find it useful for bunding water to kill *kans* grass?—It is useful, but they don't make it for that purpose; they do it for the sake of the increased outturn.

46. *Q.* What relief works had you in the last famine?—Roads and tanks.

47. *Q.* Are the States badly in want of money for these works?—A large number are impoverished and would require assistance.

48. *Q.* Would they be prepared to borrow?—Not until they paid up their present loans; many are in debt on account of the last famine.

49. *Q.* Where did they borrow?—They borrowed from the Gwalior Durbar at 4 per cent. guaranteed by Government.

50. *Q.* (*Mr. Rajaratna Mudaliar.*)—Are these plans and estimates made by Captain Ewbank for his works?—There are no plans. As generally understood, the plans prepared give the outline of the work, but there are estimates; it is a rule-of-thumb estimate made, so that any *mistry* could undertake the work.

51. *Q.* Could these works be taken up in the event of famine occurring?—Unless face walls are put in, the works would be useless, and that requires expert labour.

WITNESS No. 61.—WAMAN RAO BAPUJI, Superintendent, Alirajpur State. *Waman Rao Bapuji.*

10 Dec. 02.

(*To the President.*)—The Bhils in our State are very difficult to manage; the best thing is to get them to take to irrigation; the country being suitable for wells, I get them to dig 173 wells in Jobat and 125 in Alirajpur; but the latter were not used much and fell in. There are a number of good rivers from which irrigation can be done, but the Bhils are too lazy to use them. The wells are used by people brought from outside. I have not much hope that the example will be extensively followed by the Bhils. Wells made in the famine cost about Rs. 100 each. I have recommended that 1,000 wells be made in suitable places at a cost of 3 lakhs.

WITNESS No. 62.—LALA CHOTE LAL, Revenue Officer, Datia. *Lala Chote Lal.*

10 Dec. 02.

(*To the President.*)—We get some water for irrigation from the Betwa Canal. There are some *bandhs* in the State, but there is no irrigation from them. We make plenty of *bandhs* in all sorts of soil. There are small *bandhs* in *mar* soil, but no regular tanks. We give *takavi* for wells to the extent of about Rs. 1,000 a year. There is no fixed sum. Many wells and *bandhs* have been made since famine, and new minors are proposed from the canal. We irrigate *mar* where there are wells every year. There is no distinction between *kabar* and *mar*, and no fear of rust from canal irrigation. We grow rice in *usar* soil, but it is too far from the canal to be irrigated.

TWENTY-FOURTH DAY.

(Of sitting in 1902.)

Gwalior, 11th December 1902.

WITNESS No. 63.—COLONEL D. G. PITCHER, Director of Land Records and Agriculture, Gwalior Residency. *Colonel D. G. Pitcher.*

11 Dec. 02.

Note on Irrigation in Gwalior.

In all three divisions or "Prants," named, respectively, Gwalior, Isagarh, and Malwa, and comprising 6 districts apiece, are to be found the remains of ancient irrigation works in the shape of *bunds*, partly earthen, partly masonry. This is particularly the case with Northern Gwalior where, in 1896 A.D., famine was most severe. In the black soil tracts remains of old works are fewer in number, but are sufficient to show that it was found at some time or other worth while to irrigate such soil. To "Raja Man," who flourished about 500 years ago, is always ascribed the construction of these works. It is certain from remarks by Fryer and other travellers that in former times Gwalior was the centre of a higher class of cultivation than is now the case, and stone sugar mills or oil mills scattered all over the country, often grouped in one place in large numbers where neither cane nor oil-seed is now carried on, evidences some remarkable change of circumstances which may reasonably be ascribed to the existing waste of storm waters as compared to the practice of ancient times. Not only have the districts become arid, but the enormous quantity of surface soil washed off annually carries away with it fertility, leaving to the cultivator the labour of re-creating a fertile seed bed on the sub-soil. What appears to be called for in Gwalior is the restoration of humidity to the atmosphere by erecting reservoirs and large evaporating surfaces of water, and sites for such works abound.

The principal rivers are the Chambal, Sindh, Parbatti, Koonoo, and Betwa, all of which are crossed at points in their course by reefs of rock, but they have no snow-fed sources, and run so deep in their beds as to be useless to us for canalization save at enormous cost. The Chambal, Sindh, and Parbatti in turn have been carefully examined both in the time of His late Highness, and again since the famine of 1896. Mr. Armstrong prepared a scheme for the Sindh which would have cost some 10 lakhs and would have yielded no more than 2 per cent. at most on account of long lengths of masonry channel taken, of necessity, through barren ravines. The project may at some time be useful as a famine relief work, but it was, after full consideration, deemed wiser to spend that amount of money, if available, in the immediate present, on the construction and restoration of smaller works.

Less important rivers are the Morar, Bainsuli, Sank, Sonkera, Asan, Kuari, Son, Lon, and others, but those named are the only ones likely to yield any irrigation, and they too run very deep in bed except near their sources.

The Morar was bunded at Bahadurpur in 1898, and a channel provided with a head work has been carried for about six miles. In the rains the channel runs full, and supplies water to several villages lying in its course, filling up a number of large tanks, and protecting 1,060 *bighas* of rice. With an additional fall and extension of the channel, costing, I understand, about Rs. 6,000, it will command 2,000 *bighas*. The cost so far has been Rs. 31,563, largely increased over the first estimate by an accident from flood in the first year of construction.

During the famine several nullahs on the catchment area of the Morar were bunded up, and the result is, with reason, believed to have been a greater flow in the river above the weir after the cessation of the rains; one of the nullahs so closed at a cost of Rs 3,000 now forms the site of a new village paying Rs. 30 per annum for land formerly under thick, thorny jungle, and in all the nullahs land has been reclaimed. If more works of a similar character were carried out, for which many suitable sites exist, it is believed that the supply of *rabi* irrigation might be greatly increased; automatic shutters would also increase the supply of the *rabi*. As matters stand, unless pumping can be established, the *rabi* supply from Bahadurpur is uncertain beyond a first watering for about 120 *bighas*. In 1899 this work alone saved the rice crops of the villages supplied.

The Painsuli river joins the Morar several miles below Bahadurpur, and has a larger cold-weather supply from perennial springs. It was bunded in 1897 by a *jagirdar* at his own expense at a cost of about Rs. 15,000 British, but was turned a year or two later by an extraordinary flood; still enough land has been reclaimed from waste since the *band* was built to return to the *jagirdar* a fair percentage on his expenditure. A scheme has been prepared for taking off at Ekeira by some 10 miles of channels the spring and flood waters near the source of the Bainsuli which, if carried out, will enable the *jagirdar* to restore his work, as the floods will then come in greatly diminished force. The Ekeira scheme will fill up every year,—be the rainfall short or otherwise,—a large number of tanks yielding rice cultivation, and should have a fair cold-weather supply for wheat cultivation since the springs never fail.

There is another site below the junction of the Morar and Bainsuli which would, it is believed, yield good results, but it has yet to be properly prospected.

The Asan river runs deep; there is a vast deal of land near its banks which went waste in the famines of 1868 and 1877, but no practicable scheme has yet been formulated. His Highness last year personally examined the river and selected a site, but further enquiries demonstrated, I understand, unsuitability.

The Kuari runs very deep and runs through some *pargunas* which most need water. It can only be treated by commencing high up near the source where a good site with plenty of land on either bank suitable for irrigation exists, and then working down the stream as suitable sites may be found.

The Sank river presents an admirable site 14 miles above the city of Lashkar from which a preliminary survey

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affords reasonable grounds for saying that a reservoir might be constructed to afford a two years' supply for that city, and further surveys are now in progress. If that scheme is carried out and the floods from the 70 miles of rocky and hilly catchment area be brought under control, there are several reefs of rock across the lower part of the stream which should afford sites for storage.

The Son is a small river with perennial stream for which His Highness, when on tour, ordered a scheme to be prepared, and I understand that a large area of land is found to be irrigable therefrom.

The Sonrekha has been bunded at Jalalpore, and from it two channels, about two miles each in length, supply in the rains water to tanks met in their course, while wheat is sown in the river-bed so soon as the water falls. It is a very useful work.

This river is again bunded lower down at Susera, and supplies water by a channel for both rice and wheat. Other sites lower down the Sonrekha offer equal advantages.

Another *bund* has lately been constructed near the source of the Lonari at Bichera from which several large tanks will be supplied; other good sites exist on this source.

Across the Lon or Lonari a masonry *bund* has been thrown, diverting the flood water into a large new tank at Lohgarh. It was designed to fill by another channel several large tanks near Salisi, but rock of adamantine hardness was met with, for the cutting of which famine labour was found unequal. The tanks in question had their banks restored and raised, and, without the channel, have still been a decided success, but in a famine year the channel will be a necessity to them and ought to be completed so soon as funds can be allotted.

On the Parbatti reef of rock across the river appeared to me to offer an opportunity for forming, if crowned with masonry, a weir sufficient in height to turn flood water into a channel through several miles of good land, and communicating on either side with tanks. As at the time simple earthwork for famine labourers was urgently required in that neighbourhood, I had the channel put in hand. Subsequently a sub-overseer sent by the Irrigation Engineer to examine the depth of the rocky reef reported it to be insufficient, and the weir has not yet been constructed, but the report which was, in my absence, submitted to the Durbar shows that my proposals were misunderstood, and I have hopes that the work may yet, at some further time, be carried out.

At Singoli, in the Neemuch district, a fine masonry dam has been built, as a famine work, across a small local river, by Mr. Judd.

All the works referred to date from or subsequent to 1896.

Tanks or Bunds.

These are of four kinds—

(1) Large storage tanks behind masonry dam, fitted with sluice gates for irrigation of rice during the rains, and wheat and sugarcane during the cold season, any surplus water being left as storage. Examples are the series built, at intervals, across a line of 10 miles of drainage at a cost of about 4 lakhs of rupees, by Sir Michael Filose, from which the palace gardens are supplied. The wells along the line of drainage are always full.

Kheria, a fine work built in masonry by Mr. Harris, formerly State Engineer, and also used for supplementing the palace supply.

Udasa, Dinara, Tongra, Dhakoni, Kadroni are all old time works on a large scale with masonry dams giving both irrigation and storage.

At Sabalgarh city, again, is a masonry dam impounding a large body of water and built by Mr. Armstrong. Some irrigation is carried on from it, but its chief value is as a source of supply to the city and as affording a head of supply to the wells in the country stretching below it. In 1899 when all other wells in the district were at a very low ebb, the wells below the Sabalgarh city tank remained full, as well as those below the Tongra and Kuloli tanks.

(2) Tanks constructed for storage of water behind earthen dams, furnished with masonry escapes and sluices, and utilised for supplying water to rice during the rains, and to wheat and other *rabi* crops after the rains. Such tanks are usually constructed across nullahs, and in the latter below the weir, and apart from the channels leading from the sluices are often constructed subsidiary weirs for catching the overflow from the waste weir; thus forming a series of small reservoirs from which water is taken for *rabi* crops by lift.

Examples of such tanks are to be seen at Dobini, Tongra, Kunwarpura, and other places. Dobini was finished just before the last rains, and is maintaining about 600 *bighas* of *rabi*, but principally from subsidiary weirs, as, on account of the work being barely finished, the sluices had to be opened to allow an exceptional flood of these last rains to pass, and sufficient water for the supply of its three channels was therefore not secured. When full, the tank can supply water for 2,400 *bighas* (1,000 acres.) It has cost Rs. 50,000, mostly by famine labour, and when fully worked will return good value.

Tonga was built in 1897-98 at a cost, including channels, of Rs. 42,000, affording great relief at a time when the people of the neighbourhood were in great need of it. In 1898 *bighas* 950 were irrigated; in 1899—a famine year—*bighas* 2,563 were saved; in 1900 *bighas* 1,466 only took water, the season being one of good rain; in 1901 the rainfall was very short; and *bighas* 2,470 were irrigated and saved; in 1902 a sudden and unprecedented flood breached the waste weir, and the water was lost save in the subsidiary weirs, from which about 400 *bighas* of wheat, etc., are under irrigation, and, in addition, the whole of the tank bed has been cropped for wheat. The weir is now under repair, and if the channels be extended, the area irrigable amounts to 5,000 *bighas*.

(3) Tanks for storage of water and irrigation, during the rains, of rice, the surplus water being run off after the rains, and the exposed bed of the tank cultivated for wheat of which the finest possible crops are thus raised year after year without manure and without any further irrigation. In the famine year of 1896 such tank beds and the exposed beds of rivers and streams gave us in addition to what were raised near wells the only crops realised. Such tanks are found everywhere in black soil as well as in other soils, and it is particularly worthy of notice that examples are fairly numerous of *usar* land being gradually reclaimed inside tanks of this kind, and of *usar* soil of a bad class yielding good crops of rice if amply supplied with water from such a tank. It seems from our experience in Gwalior to be worth while trying whether in Oudh from a tank dug in *usar* soil rice crops could be raised on its banks, water being supplied by lift.

(4) Tanks built for the storage of water throughout the year for supplying man and beast in otherwise waterless tracts. Examples of these are tanks that were built in 1897 and subsequent years at Panwara, Amrit, Agra, Karahal, Khirkheri, and other places in the Sabalgarh and Sheopur districts. In the Karahal pargana the tanks above named were all fully reconstructed on the sites of ancient works of unknown antiquity. Owing to the destruction of these works the pargana lapsed from a state of prosperity into jungle, and for many years previous to 1897 for some 40 miles water was hardly procurable. In the neighbourhood of Panwara alone are the sites of eighteen deserted villages. A supply has now been established that is pretty evenly distributed over the area affected, but much more remains to be done. It is noticeable that to each of the tanks named can be traced the source of a small river. Such are the Sip and the Seari, both of which run dry now in the hot weather, but are said to have been formerly perennial. It is hoped that the rivers will in time again become perennial. Khirkheri is a very fine work, affording a fine sheet of water: the ruins of the old village prove how large the population must at one time have been.

Wells.

These are, as elsewhere, *kachcha*, *pakka* or *kachcha-pakka*, and may be classed into wells used for drinking purposes only and wells for irrigation.

Without a well for drinking purposes a new hamlet cannot be founded, and new hamlets, as increasing the area of the highest, that is, the manured and irrigated, class of cultivation, stand in the front of agricultural improvements. Even if a hamlet be not founded, outlying tracts of good land often lie unutilised; because the would-be cultivator cannot obtain within a reasonable distance water to slake the thirst of himself and of his cattle during their day's toil. Many wells have been sunk with this object.

As to *kachcha* wells, the factors are a sufficiently stiff soil, and water sufficiently near the surface to suit the strength, for raising it, of the local breed of cattle. Where these factors are all favourable *kachcha* wells are freely sunk by zamindars and tenants alike.

For *pakka* wells also costing from Rs. 200 to Rs. 1,200, according to depth of well number of pairs of bullocks to be used and consequent width to be given, advances have

been given by the State most liberally for the last six years. For five years of that period the Land Records Department advanced direct, and for the last year *sar-subahs* and *subahs* have advanced. There is no difficulty experienced in getting applicants to come forward; the rate of interest is low, being 4 per cent. for the first year, and 6 per cent. for subsequent years. Land irrigated from wells sunk during the course of a settlement is assessed at the settlement next following at dry rates. Well-sinking by private means is on the increase, but much remains to be done, as will be seen from table appended showing *kacheha* and *pakka* wells per square mile of total area in use during the past three years 1899-1900 (famine year), 1900-01, 1901-02. The average all over the State works out to five *bighas* cultivated area per well, which seems very low, but the cattle are small and poorly fed.

Colonel D. G. Pitcher

11 Dec. 03.

A note on irrigation in Malwa drawn out by Mr. C. Judd, Divisional Engineer, is appended.*

Statement showing area and number of pakka *and* kacheha *wells in actual use.*

Serial No.	Name of District.	Area in square miles.	Sambat 1956, 1899-1900.		Sambat 1957, 1900-01.		Sambat 1958, 1901-02.		Remarks.
			Pakka or pakka-kacheha.	Kacheha.	Pakka or pakka-kacheha.	Kacheha.	Pakka or pakka-kacheha.	Kacheha.	
1	Bhind	857	1,284 / *1·49*	1,560 / *1·82*	1,035 / *1·20*	398 / *·46*	1,074 / *1·25*	461 / *·53*	
2	Tomarghar	720	1,689 / *2·34*	2,153 / *2·99*	1,750 / *2·44*	1,239 / *1·72*	849 / *1·17*	911 / *1·26*	
3	Boid Gwalior	1,124	3,519 / *3·15*	639 / *·56*	2,628 / *2·33*	242 / *·21*	3,125 / *2·78*	598 / *·53*	
4	Sikarwari	843	2,287 / *2·71*	1,493 / *1·77*	2,198 / *2·60*	751 / *·89*	1,980 / *2·34*	1,159 / *1·37*	
5	Sabalgarh	1,122	1,906 / *1·60*	1,725 / *1·53*	1,797 / *1·60*	1,209 / *1·07*	1,841 / *1·64*	1,618 / *1·44*	
6	Bhandero	513	978 / *1·80*	2,262 / *4·16*	828 / *1·52*	721 / *1·32*	939 / *1·72*	759 / *1·39*	
7	Narwar	1,139	2,330 / *2·04*	290 / *·25*	2,348 / *2·06*	240 / *·21*	2,275 / *1·99*	454 / *·39*	
8	Sheopore	910	255 / *·27*	47 / *·05*	224 / *·23*	93 / *·09*	228 / *·24*	117 / *·12*	
9	Bhilsa	1,400	813 / *·58*	359 / *·25*	807 / *·56*	384 / *·28*	601 / *·42*	440 / *·31*	
10	Isagarh	1,611	1,573 / *·97*	433 / *·26*	1,517 / *·96*	447 / *·27*	1,381 / *·85*	546 / *·33*	
11	Pitchore	1,780	5,062 / *2·84*	3,102 / *1·74*	6,710 / *3·76*	3,119 / *1·75*	5,963 / *3·35*	3,426 / *1·92*	
12	Bajrangarh	1,055	1,782 / *1·68*	1,218 / *1·15*	1,857 / *1·76*	1,181 / *1·11*	2,107 / *2·09*	2,058 / *1·9*	
13	Ujjain	1,505	1,226 / *·81*	2,170 / *1·44*	1,162 / *·77*	1,937 / *1·28*	867 / *·57*	1,812 / *1·20*	
14	Shajapore	2,220	1,341 / *·60*	3,900 / *1·75*	1,388 / *·62*	3,880 / *1·74*	1,178 / *·53*	3,449 / *1·55*	
15	Agar	1,273	2,004 / *1·64*	6,407 / *5·03*	2,185 / *1·71*	6,357 / *4·19*	1,715 / *1·34*	4,101 / *3·22*	
16	Mandasore	728	407 / *·55*	3,467 / *4·75*	559 / *·76*	3,516 / *4·84*	421 / *·56*	3,680 / *5·05*	
17	Neemuch	992	2,438 / *2·45*	1,913 / *1·92*	3,364 / *3·39*	2,629 / *2·65*	1,574 / *1·58*	2,791 / *2·88*	
18	Amjhara	1,301	192 / *·13*	556 / *·20*	208 / *·15*	597 / *·45*	195 / *·14*	576 / *·41*	

Figures in *italics* show the average number of wells per square mile.

1. (*The President.*)—Will you be so kind, Colonel Pitcher, as to read such portion of the Note you have prepared for us?—[Note read.]

2. *Q.* Is there any one part of Gwalior State where the rainfall is heavier and more reliable than another?—No, there is no such place; perhaps the black soil tracts, as a rule, get most, and suffer from rust. The fall is heaviest in the south. The rainfall in the portion of the State north of the Vindhyans in 1896 failed partially and in 1899 completely.

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3. Q. You have sketched out a very extensive programme of *primâ facie* works; quite enough, I suppose, to tax the resources of Gwalior for many years?—Yes.

4. Q. You also, I believe, lay great store upon village irrigation works?—Yes.

5. Q. You have carried out a great number of these?—They were carried under general instructions from me.

6. Q. When did you begin to carry out these minor irrigation works?—In the beginning of 1897.

7. Q. They were a new thing, I suppose?—Yes; from enquiries made I understand that works were formerly carried out most irregularly and unscientifically; enormous arrears of water-rates had to be written off.

8. Q. As regards the works begun in 1897, have you been able to see what the result has been?—Very beneficial; the general effect is that the revenue in those tracts in which most money was spent on irrigation has since been paid with the greatest regularity.

9. Q. Has any new land been brought under cultivation?—Famine came in 1896, and 1897 was a fairly good year; in 1898 we made a summary settlement. The average collections of three good years before the famine year were 40,18,000 British rupees; then we began irrigation, and a *jama* was fixed at the re-settlement in 1898 of Rs. 50,66,000; including the arrears of the famine year in which suspensions were made, collections for 1901 and 1902 averaged 55 lakhs of rupees per annum.

10. Q. Do you think the greater part of that increase may be fairly ascribed to these 200 tanks you built?—No; two effects were observed; in the first place, revenue has been paid with far greater ease than before; and, again, those districts in which most money has been spent are the districts that pay with greater completeness and punctuality.

11. Q. Are these minor tanks not generally supplied with sluices?—I think they are; there are two kinds of tanks; those in which water is let out and the bed cultivated, and those in which the water is retained.

12. Q. In spite of running the water off is there any appreciable addition in the raising of the spring level of wells?—Yes, of course; I have not made detailed experiments. The wells below a tank in Sabalgarh City gave a good supply when other wells in the district failed.

13. Q. As your experience in regard to these minor tanks is of the highest value, we shall be grateful if you will jot down a few facts which have come under your personal observation. Have you had any opportunity of seeing a deposit of silt formed in these little tanks?—Yes. I know of ravines in which the land was previously uncultivable and useless, and in which by the introduction of silt the land has been made to yield Rs. 200 to Rs. 300, but the policy is to take no revenue on improvements until the next settlement of the land revenue.

14. Q. Have you been able to form any estimate of the cost of reclaiming an acre of land in this way?—No.

15. Q. Do you think, from your general experience, there is reason to believe that by extending the system of minor irrigation there has been material improvement made in the matter of checking denudation?—Yes.

16. Q. At no extravagant price?—Certainly.

17. Q. (*The President.*)—I think in the *mar* land to the south of Gwalior there are remains of many old tanks?—There are some old tanks there, but not so many as in the other soils. As far as I can learn, it was in 1720 or 1750 that Ragonath Rao Peshwa marched up towards Gwalior; from that time constant warfare commenced and the country suffered greatly, while many of the tanks fell into disuse.

18. Q. Did climatic change follow the destruction of the tanks?—Yes

19. Q. I suppose it is contemplated to restore a number of these tanks?—Yes. I believe His Highness is favourably inclined towards restoring them. Last year he went out on tour personally, visited many villages alone, and selected sites for wells and tanks, and distributed about Rs 50,000 for that purpose, but I may mention that our great difficulty here has been, and will be, the want of competent subordinates. In the famine of 1896, directly I got charge as central officer for famine relief, I wrote to the Public Works Departments and the Chief Engineers of the United Provinces and of the Punjab asking their assistance, but was told that I could not have a single man. As to the sub-overseers, we had to take the leavings and cast-offs of the provinces, some of whom had gone through very curious experiences, which were not very satisfactory.

20. Q. (*Mr. Muir-Mackenzie.*)—I understand that His Highness is thinking of starting an Engineering College here?—Yes. There is one thing also about Roorkee training, that is, it has no application to Gwalior. Beyond teaching arithmetic, levelling and surveying, the instruction has no application to the conditions of the country and to the small works and large works needed in Gwalior. The men must come here and have a local training.

21. Q. (*The President.*)—I should think it might be a good thing if you were to send up a few Gwalior lads for partial training in these preliminary subjects, perhaps at Roorkee, and then let them come down here. Roorkee would have to take them in on the understanding that they were not available for general service, but for the Gwalior State?—That might work.

22. Q. Have you got a personal experience of Bundelkhand?—Only in marching tours. I have marched all over Bundelkhand.

23. Q. I suppose the Agency and Lalitpur are similar?—Hamirpur and Banda are more like the country down towards Bilsa, all black soil, though some parts of Banda resemble the districts near Gwalior.

24 Q. And Jaloun?—Is more like Bilsa; it is nearly all black soil plains.

25. Q. As regards Lalitpur and Jhansi, do you believe there that the system of making tanks would be useful?—I am sure it will. When I was there I had a great deal of conversation with Major Bellasis, the Executive Engineer, who was very much set on building tanks. He was not always successful in his tanks, because he went there without experience, but his ideas were right as to the advantages of tanks.

26. (*Sir Thomas Higham.*)—The difficulty is whether they can get good sites there. The soil is not good to irrigate?—Then comes in my idea about evaporating sites. The tank you saw the other day is so far of no use for irrigation. It is still a useful reservoir, which if the State has money it should build in numbers for evaporating purposes for the general benefit of the climate of the country.

27. Q. Whether land is irrigated or not?—Yes.

28. Q. Of course the benefit will be enormously increased if you had land to irrigate?—Of course it would be, but I would not confine the idea of benefit simply to irrigation. If you have only a small amount of money to spend, for which you must have a return, that is a different thing, but where money is plentiful it will be most beneficial to increase these reservoirs as far as your funds will allow.

29. Q. Anyhow, they will improve the well irrigation probably?—Undoubtedly.

30. Q. Have you decided how far the spring level of a well is affected by that?—I have not decided.

31. Q. I suppose there is a good deal of well irrigation in Gwalior?—A fair amount; it is increasing very rapidly. In addition to the works that are mentioned in the list I gave you, two lakhs and odd under my direction have been given in advances. In the famine I spent a good deal, and then I got Rs. 50,000 a year from the Board of Revenue for distribution; since I went home on leave two years ago His Highness has given this money to the Commissioners and Collectors to distribute. I have got a list of the amounts so distributed last year.

32. Q. What does it come to about?—In one division Rs. 63,235 and Rs. 40,617 in the other. One division had Rs. 1,32,000 and the other Rs. 1,36,000 placed at its disposal for advances, and the *subahs* are now out in camp personally inspecting sites and giving advances for wells and tanks. The interest is either Rs 4 per cent. or 6 per cent. according to the period for which the loan is taken, and I think they will repay the money by next settlement.

33. Q. You mention in your note some deep nallas across which you propose to put a bund high up near the sources to get water out on the land?—No; to check the water and keep it there, and let it soak in. It is not to irrigate, but to let it soak in.

34. Q. I understand you proposed a bund high up the nalla?—That refers to the river Morar, and the nallas go in all directions, and there are a number of them. What we did in the famine was to bund them up at the mouth; the water very soon subsided into the sub-soil, and when it subsided the area has been cultivated behind the bund. I looked to these for supplying the spring sources of Bahadurpur down below.

35. *Q.* Would you go down below?—I don't propose to go much further, about seven miles. The back-water at Bahadurpur leads back 1½ to 2 miles.

36. *Q.* What did you do at Bahadurpur?—We have got a weir across the river.

37. *Q.* Could you get this water on to the country?—Yes, throughout the rains it goes out six miles into big tanks, and fills them.

38. *Q.* I understood from your note that in cases like this you propose to also make bunds across the nallas?—Across the feeder nallas; not across the main nallas.

39. *Q.* How will all these nallas affect the Morar?—I want to stop every one of these to regulate the floods.

40. *Q.* Then it is no use making bunds lower down?—I cannot say. It will be a long time before we get there. It is only a general idea I express here. The only way to try that is to begin high up and gradually work down as you find it practicable.

41. *Q.* You say if you make these great tanks, they will always be of benefit on account of the wells?—Yes, and the surface afforded for evaporation.

42. *Q.* That is a separate thing. In regard to wells, take that tank we went to see the other day: that would only benefit wells round a very narrow fringe?—It would benefit down stream.

43. *Q.* How many miles?—Only about seven or eight miles to Pichore.

44. *Q.* The total area of irrigation that you benefit from a tank like that must be very small?—It is not large.

45. *Q.* Then you must rely on the value of your evaporation, but one thing about the evaporation is that it is intangible. You can never measure what good it is doing?—I am afraid I can give you nothing tangible, not even about wells, as we have no figures.

46. *Q.* (*Mr. Muir-Mackenzie.*)—What is your theory about the wells? Do you benefit a certain number of wells on either side of the stream?—My theory is that by bunding small rivers and streams you increase the water in the wells in the country on either side of the channel below the bund. It is a known fact, however, that with deep rivers like the Ganges, near the banks the wells are deepest you could find anywhere, and I don't think that has ever been explained.

47. *Q.* But as regards the tanks with small streams running through them? In the Deccan we found wells are all deep close to the main nalla, and what I wanted to know is whether your understanding of this aid to wells is that it increases the supply of water in the bottoms of the wells fully near the main nalla?—Yes, when such wells are below the bund. Mr. Judd states that in the Singoli district the majority of wells this year are very low or dry, but below Dhanjoun Tank, which was made in 1900, all wells are full for a distance of three miles in the valley. May I also read this note in which I say that in pargana Karahal, which is about 1,700 feet above the sea, there is a tract of about 40 miles of waterless tableland. Round about one ruined tank lie eighteen villages depopulated through the want of water for the cattle and people to drink. We found remains of old tanks all along there, and the people say that when those tanks were kept filled the population was pretty large.

48. *Q.* Is the soil pretty good?—Yes. At the head of each of the rivers flowing during the rains from this tableland was found the ruins of a large tank. I have had the tanks restored and kept filled, and the people all assert that the rivers now run for a longer period instead of drying up soon after the rains.

49. *Q.* What has the effect of this been?—A more regular supply in these rivers, and the spring supply in the rivers below is now more than it was before we restored these tanks.

50. *Q.* Have the people come back?—They are beginning to come back.

51. *Q.* Do you suppose these tanks were formerly used for irrigation, or simply for holding up the water?—Probably for holding up the water. Vast herds of cattle graze in those forests, and in the hot weather they leave the forests because there is no water. Now we are giving them water they are coming back. In the Rajputana famine we had herds of cattle and crowds of people come over to our forests wherever we had tanks.

52. *Q.* (*Sir Thomas Higham.*)—I understand that in the case of all these protective works that were made during the famine no charge has been made for the benefits that have been received; no water-rate has been put on because of them?—No.

53. *Q.* That will remain until the next settlement, I suppose?—That depends on His Highness. We have had one settlement since the famine, and we have taken the benefit of our works up to that settlement.

54. *Q.* You gave us some figures just now showing the increase of revenue as compared with the years before the famine. Is that due to the additional revenue taken on that settlement?—Not entirely. It is partly due to that, but I cannot say precisely. What I claim as very largely due to it is the regularity with which the revenue has since been paid.

55. *Q.* That is to say, you have given fewer remissions?—We have given no remissions since then. In 1899 we suspended revenue, but did not remit, and have since collected such suspensions.

56. *Q.* The increase of revenue has not been due to a water-rate?—No.

57. *Q.* There has been a partial enhancement of the assessment made at the settlement of 1898?—Yes.

58. *Q.* And you think that these works, taking them altogether, will be directly remunerative in the increase of revenue derived from them?—Undoubtedly.

59. *Q.* You think the money spent a good financial investment?—Undoubtedly.

60. *Q.* Apart from the saving of expenditure on famine relief?—Yes; I think that at next settlement the revenue will be increased through the medium of these works considerably to what it would have been had these works not been constructed.

61. *Q.* (*The President.*)—It would pay, would it not, to have these works done by contract?—That was the case in the time of Doulat Rao Scindia, when the revenues of the districts were farmed out to contractors who keep these works in repair, and it was found that it paid the contractors. You have heard of the millionaire Seths of Muttra; they were contractors of revenue under Gwalior, and walked away with crores of rupees?

62. *Q.* This statement shows the population, gross area cultivated, and what you can protect by irrigation?—Yes, in a year of drought.

63. *Q.* Has this area been very considerably affected by the works constructed?—These figures have only been systematically collected of late years.

64. *Q.* Do you think you could protect a much larger area now than you could in 1896?—Yes. I am quite sure that a larger area is now protected than in 1896.

65. *Q.* The expenditure on protective works amounted to about Rs. 2,00,000?—About that; Rs. 2,80,000 is the amount.

66. *Q.* These were the works constructed during the famine time?—Yes.

67. *Q.* And in respect to that expenditure do you suppose the area has been very greatly increased that has been protected?—Not in proportion. It was done by famine labour and was expensive; the same amount spent in an ordinary year will probably give you double this number of works. But so far as these works went, there was protection.

68. *Q.* You have not told us anything about field embankments in black soil. Do you do much of this here?—On fields in a sloping country they raise these bunds, which you call embankments, and check the flow water.

69. *Q.* What part do they do that in?—In black soils, where there is no irrigation from wells, you find these embankments.

70. *Q.* Were any embankments of that sort made as relief works?—Yes, where there was a favourable slope.

71. *Q.* Do people make them by themselves?—Yes, they have taken advances for that too.

72. *Q.* In regard to wells did they run dry in the famine?—Yes, very largely.

73. *Q.* Was there much cohesion of the wells?—Yes, very great.

74. *Q.* Did you find in any case that they were able to replenish the supply by boring down through the rock underground?—We have tried getting through the rock, but there are few cases in which we have been successful so far.

75. *Q.* Do you know any cases in which there has been a spring up from beneath the rock?—I cannot cite a

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case. Mr. Taylor might be able to do so, but I don't remember a case.

76. Q. (*Mr. Muir-Mackenzie.*)—As regards this irrigated area from all sources given in your statement, does that mean from wells?—Wells and tanks.

77. Q. We are not able to differentiate what come from tanks?—You can for this last year, 1901-02. I am beginning to differentiate it now, and you will find that this return gives the irrigation figures within the year. I have great trouble in getting this correct, but in another two or three years I hope to get it really accurate.

78. Q. One thing that we observed in the United Provinces, for instance, was that in the famine year 1896-97 the area under tank irrigation decreased enormously, because the tanks did not hold water, and the area under well irrigation increased enormously?—Their tanks are so different to ours. The tank in the United Provinces is all irrigation from lifts.

79. Q. The greater part of this irrigation of yours is in the bed of the tank?—Yes

80. Q. Behind the bund?—Yes. The average for tanks all through was 21·65 *bighas* below the bund and 31 above—a ratio of 3 to 2.

81 Q Was that 31 *bighas* generally uncultivated before?—Yes, before that they were sown for a *kharif* crop, but not a *rabi* crop.

82. Q There is another point in these figures which I don't understand. For the Malwa Branch I observe in the normal year you have very nearly double as much as in the year of drought What is the difference due to?—It is probably from wells.

83. Q. The nullas failed?—Yes.

84. Q. On the other hand, in Gwalior, I see the area rose. There is a great deal more well cultivation in Malwa than in Gwalior?—The reason of sinkage in Malwa was that in the dry year of 1899-00 there was a failure of wells. Seventy-five per cent. of the wells ran dry in Malwa. The water-level only reached its proper level this year.

85. Q. Malwa was affected by the 1899-1900 famine?—Yes.

86. Q. Gwalior was not?—It was affected, but not so severely as Malwa. You were asking me about the boring of wells just now. Mr. Judd has given me a note in which he says "deepening wells where trap rock is found was a failure, unless great depth be taken. The average of wells is 40 to 50 feet. One well, 60 feet, was deepened to 110, and then a fault in the rock was reached, and the water rose 25 feet in the well." That was one successful case, and I know one at Sehore in trap rock which was also successful.

87. Q. Have *takavi* advances been given in the Gwalior State under your supervision and orders?—Yes.

88. Q. What is the exact method which you pursue in the giving of them? Does a man come in to you for the money, or do you send it to him?—The men came to me with their applications, and I made enquiries through my *kanungos* in the village, if I thought it was necessary, and then gave him the money.

89. Q. Is the fact of his having to come in a long distance a great deterrent?—No.

90. Q. It is urged in British territory that it is a great deterrent?—I believe not. I was in Hardoi nearly a year and a half, and the year after my arrival I gave Rs. 50,000 in that district alone as *takavi*, and they all came to me and got it. I could not give as much as I had applications for.

91. Q. Did they come to you in camp?—To the Cutchery principally.

92. Q. That is to say, at head-quarters?—Yes. After I left, my successor instituted inquisitorial rules, and the people would not come in for *takavi*, and Government enquired why the *takavi* advances had decreased when I left.

93. Q. Of course it might be urged that the reason why the people took the advances was that they were able to misappropriate them to purposes other than that for which they were given. Do you believe much misappropriation did take place?—No doubt, it did to a certain extent.

94. Q. To a large extent, do you think?—No.

95. Q. Do you think that, if without too close an enquiry you gave a man money for a well, you might be confident that a greater part of that money would be spent on the well?—That is difficult to answer precisely, but I was confident that every advance I gave would be recovered.

96. Q. You deprecate too much inspection?—Too inquisitorial inspection, because it means that the men you send to make these enquiries will take their percentages.

97. Q. What period is allowed for repayment of *takavi* in Gwalior?—Various terms. I think it is now three or four years. In the famine time we gave six years. His Highness has been very liberal this year in giving advances to *subahs* and *sar-subahs*, and they have to go on their tours and see on the spot who wants the money and give it to them themselves.

98. Q. The people are quite content to pay back in four years. They don't find the period too short?—No, they take it very readily.

99. Q. What sort of security do you take?—I think we take nothing except their land.

100. Q. Then it is always to zamindars that you advance?—I have always advanced to zamindars.

(*His Highness the Maharaja.*)—There used to be a lot of trouble about this formerly, so now I have ordered the Collectors to judge from the character of the person and his property, and if they are satisfied that he is a proper person, to give him the money on the spot.

101. Q. (*Mr. Rajaratna Mudaliar.*)—Do you give any remissions when wells fail?—Where we have built them we don't charge at all.

102. Q. But where you have advanced *takavi*?—They don't get remissions; they must take the responsibility.

103. Q. (*Mr. Muir-Mackenzie.*)—You were in charge of the famine relief works in 1896-97?—Yes.

104 Q. Did you manage to employ a greater part of your labour on irrigation works?—No.

105. Q. How large a proportion?—You have it all in this famine report. The average of labourers per day on these works were 1,297.

106. Q. Did you manage to get irrigation works for one-fourth the number, or one-third the number?—I could not tell you without studying the figures again; the figures are to be found in this report.

107. Q. Have you got a programme of future works?—Yes.

108. Q. What proportion is irrigation?—They are all irrigation. The programme for famine relief is entirely irrigation works.

109. Q. Does that mean in your real famine you hope to employ everyone in irrigation works?—We will employ them on that as far as we can in preference to any other work.

110. Q. Do you believe you could find employment for them?—I don't doubt it, if I can get the money.

111. Q. You could find irrigation works to employ them?—Yes. I believe there is scope for employing the people, and near their villages too. In 1877-78 I gave the opinion that in Oudh the people should be employed near their villages on tanks.

112. Q. For irrigation as apart from drinking water-supply?—No; the two together. As a tank is useful, whether for irrigation or for water-supply, or as affording evaporating surface, the more you can get the better for the country.

113. Q. You say you would employ the greater number of them on tanks of some sort?—I think the greater part would be for what we call irrigation here.

114 Q. Either for irrigation behind the bund or below the bund?—Yes, and for embankments.

115. Q. I wanted to ask you one or two questions about Oudh. You served there a great deal?—Yes.

116. Q. You made some very special enquiries, did not you, after the famine of 1878?—Yes, as to the rates of mortality.

117. Q. Your enquiries were in Rohilkhand?—Yes.

118. Q. You found there had been very considerable mortality there?—Yes. The question was whether the mortality was correctly reported or not. The Famine Commission took the United Provinces Government to task for the mortality and assumed that the recorded figures were 25 per cent. below the actual figures. Government did me the honour of asking my views upon this, and I said that was a wrong assumption to make before you were certain that the reporting was correct, and that the only way of arriving at it was to divide the worst villages into circles and make a house-to-house enquiry in these villages. Government

thereupon said "you are to do it," and I had to do it for Rohilkhand. I found just the opposite, and that it was reported 25 per cent. over what the actual figures should have been, and that everything was put down to famine, because there was a great outcry about the reporting, and the *chaukidars* reported every death they could as due to famine.

119. *Q.* Allowing for all the exaggeration, the mortality was severe?—Unquestionably; but there were no grounds for exaggerating.

120. *Q.* The only point or question is whether you consider that Rohilkhand might again be exposed under certain circumstances to famine?—Undoubtedly. I happened this morning to find my diary of 1878, and there I found that a canal from the Ganges was formerly proposed going through the Bijnor district. In fact, the people pointed out where the pegs had been laid down for it. Everywhere, where the place was through which the canal was to pass, they eagerly enquired and they begged that I should use my influence towards bringing the canal into their district.

121. *Q.* (*Sir Thomas Higham.*)—Their ideas were influenced a good deal, were they not, by what they had gone through?—Yes; they pointed out the prosperity of the villages on the other side of the river, and asked when we were going to benefit them in the same way by bringing a canal into their district.

122. *Q.* Did the owners say the same thing?—These were the small zamindars and cultivators. I don't suppose the taluqdars would have said the same thing.

123. *Q.* (*Mr. Muir-Mackenzie.*)—You were also on the Provincial Committee which enquired into the famine?—I was Secretary to the Local Famine Commission.

124. *Q.* Did that Commission advocate any irrigation works in Oudh?—I don't remember its doing so. I personally advocated the digging of tanks as the best form of famine labour in the neighbourhood of villages in Oudh.

125. *Q.* Did you advocate the Sardah Canal?—I cannot say. As Secretary I had to compile all the replies received from all officers in all districts. If there is anything, you will find it in these printed replies.

126. *Q.* Have you any strong opinion about the Sardah Canal?—Very strong. I was in Lucknow when the Sardah Canal was started, and Colonel Forbes and his office assembled there in the year 1870, and I had many talks on the subject with him and with his assistants, Mr. Hancock and Colonel Clibborn.

127. *Q.* What is your view about it?—My view always was that the Sardah Canal should have been constructed on a less ambitious scale than was first proposed; that is to say, it should have been constructed not as a navigating canal, but as an irrigating canal only. It should have been carried out in the way proposed subsequently by Captain Cubborn in an amended scheme, which was to take the canal into parts where it was required and not into those parts already fully furnished with wells. I think that plan is the only one on which the Sardah Canal could have been successfully constructed, and that it could have saved the country from famine in 1877 and also in 1896.

128. *Q.* (*The President.*)—Was there much misery in Oudh in 1877?—Yes.

129. *Q.* Did you find at that time that the taluqdars were actively opposed to the canal?—I found that the taluqdars were the only people who had a voice in the matter. They were led by a taluqdar through whose estates the canal would have run; and although I cannot guarantee the correctness of it, the general rumour then was that the zamindars in those villages were sub-proprietors, and would become too wealthy and powerful by the opening of the canal for his views.

130. *Q.* Used apprehensions never to be expressed as to the water-logging of the country?—I don't remember any apprehension as to water-logging. Apprehensions were expressed, to the best of my recollection, that the Gogra would cover the land with silt, and that the fertility of the soil would be destroyed by a coating of sand.

131. *Q.* The spring level in Oudh is generally high; is it not?—No. It varies very much in some districts.

132. *Q.* Would you not personally be afraid of water-logging if the canal was built?—Not if it were properly aligned and you had drainage when necessary. When I was in Lucknow I had charge of an estate which was under the Court of Wards. I commenced digging wells there and I found they went down to 80 feet deep, and that the Sardah Canal was going exactly along the line where I had constructed two wells. I stopped the rest, and never constructed them. Then when I went to Hardoi I again found the Sardah Canal went along the tract where they wanted most water.

133. *Q.* (*Mr. Roberts.*)—How long is it since you have left Oudh?—12 years.

134. *Q.* Have you seen Mr. King's report on the Sardah Canal drawn up during Sir Antony MacDonnell's time?—No, I have not seen that.

135. *Q.* You have not seen the proposal by Sir James LaTouche about a modified canal for Hardoi alone?—No.

136. *Q.* There is a proposal there that a canal, merely as a protective work, should be considered with a view to supplying water to the tanks in years of deficient rainfall. Do you think that would be a good thing?—From what river will this canal come?

137. *Q.* From Sardah.—It would not only benefit Hardoi, but would apparently benefit parts of Shahjehanpur where mortality was very heavy in 1877.

138. *Q.* Then about the opinion of the people which is a factor in the case: we have examined a good many taluqdars at Lucknow on this subject. They had all come prepared for this question about the Sardah Canal, and they gave a great many reasons against it. One reason was that it would raise the water-level?—The water-level wants raising in Oudh in many years.

139. *Q.* The report of the Engineer, Mr. King, is that the water-level is high enough and should not be raised?—I happened to find a tour report of mine of 1882-83, and there I find the water-level had fallen to an extraordinary extent in many places, and the people were working hard at the wells, often without bullocks, could not get enough water. Fortunately there was ample late winter rain and the crops were saved; otherwise there would have been a failure of the *rabi*, and we should have had severe distress.

140. *Q.* (*Mr. Muir-Mackenzie.*)—Did the *rabi* fail in 1877-78?—No, I think it was only the *kharif* that failed.

141. (*Mr. Roberts.*)—You gave us one reason why the taluqdars should be opposed to it, and that was because of the sub-proprietors. But there is a very large area not under sub-proprietors, and from those tenants they would get an enhanced rent?—Precisely; but you know that from the time of Mansingh and the Tenancy Acts a feeling of enmity has existed between the sub-proprietors and the taluqdars.

142. *Q.* And your idea is that they are not willing that the sub-proprietors should benefit, though they benefit themselves?—I believe they are influenced by the feeling that the sub-proprietor's position would be so greatly increased as to make him a more powerful enemy than he is now.

143. *Q.* Mr. Butler also laid great stress on the fact that wells are increasing rapidly—so rapidly that the ground for reporting that the canal should bring water is less than it was before, and he gave us figures which showed that in Rai Bareilly, Bara Banki and Pertabgarh the number of wells had enormously increased. You said you gave Rs. 50,000 as *takavi* in Hardoi in one year. Which kind of *takavi* was it?—For bullocks and for wells, because the wells are of no use without bullocks.

144. *Q.* Have you any idea what a well costs?—Rs. 300 to 400 according to the depth of water and according to the number of bullocks used.

145. *Q.* To whom did you give the advances for wells, as a rule?—To the zamindars. There is no difficulty about security with them.

146. *Q.* Yes, because you have his land. But how did you manage about advances to tenants?—I only gave an advance to a tenant on the security of the zamindar.

147. *Q.* If a zamindar refused, a tenant could not get an advance?—No.

148. *Q.* In your opinion there is no practicable way of giving *takavi* largely to tenants unless the zamindars join?—I have no doubt of that. The fertility of soil is inexhaustible if treated in a proper way. The fertility of soil is similar to coal in a coal mine. The owner of a coal mine allows persons to come in and dig for coal. If they take it with a shovel, they pay a royalty per ton; and if they put in costly machinery, they pay the same royalty per ton, but as the output is greater they have to pay a larger sum as royalty. It is the same in the case of the zamindar and his

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tenants. The zamindar stands in the position of the owner of a coal mine, and if his tenants by making improvements get an increased crop, the zamindar has a right to share in the increased outturn, and the tenant should not be allowed to appropriate the whole of that increased fertility to himself.

149. *Q.* From that point of view you see no injustice where a tenant has dug a well that he should pay wet rates for land irrigated from that well?—Certainly not. I may say it is the opinion in this State, and it is acted upon, that any tenant now can sink a well, although his zamindar is opposed to it, but that he shall pay an increased rate according to the irrigated rates in the neighbourhood, if he does it without coming to some private and previous agreement with the zamindar.

150. *Q.* One objection to our present system of giving *takavi* is that a great deal is exacted by underlings. Do you think that amounts to any very large percentage of the sum advanced?—It used to, but I don't know what it does now. Soon after going to Lucknow I got a tahsildar in the treasury run in and convicted for taking 5 per cent. as commission on *takavi* advances.

151. *Q.* Is there any practicable way of preventing that?—The only way is by seeing it given yourself.

152. *Q.* But the people themselves are in such a way that they will pay?—Yes, unless the people show more independent spirit and complain, and unless you listen to their complaints, you cannot prevent this.

153. *Q.* But they won't complain of small exactions?—No.

154. *Q.* The rate of interest for *takavi* is 6¼ per cent. Do you think that rate is too high?—Well, the argument generally is that Government can borrow money at 3½ per cent., but you must leave some margin for tenants dying and bolting, and losses of that kind. I think 6¼ is as low as it reasonably can be put.

155. *Q.* The rate of interest, then, is not a deterrent at all?—No. It is not excessive.

156. *Q.* (*Mr. Rajaratna Mudaliar.*)—Would you recommend its reduction to 5 per cent. as in other provinces?—In Oudh I should leave it as it is; I don't think that the present rate is deterrent.

Witness No. 64.—Mr. H. B. Taylor, Chief Engineer, Gwalior.

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1. *Q.* (*The President.*)—How long have you been Chief Engineer here?—Two-and-a-half years.

2. *Q.* I understand your experience before was on railway works?—Yes, purely; my experience in irrigation is solely gained here.

3. *Q.* Do you consider Gwalior is now better able to stand famine than it was on the last occasion?—I think certainly that it is; a great deal has been done lately; within the last few years we have been spending 5 to 6 lakhs a year on irrigation; the budget this year is for 6 lakhs.

4. *Q.* Is that chiefly in making new tanks or in repairing old ones?—Principally new tanks; a certain proportion of old tanks were reconstructed.

5. *Q.* Colonel Pitcher said there were a great many old tanks?—Yes, there are.

6. *Q.* They are strong evidences of the prosperity of the old days?—Yes.

7. *Q.* Have you any water storage on a large scale?—Nothing at present; there is the Sind river scheme, but it is too expensive to be taken up at the present time.

8. *Q.* What is the size of the Sind?—It is half the size of the Betwa; the drainage area must be the same as the Betwa; we propose to store it in a ravine.

9. *Q.* Is the Sind works a canal to be fed by a reservoir?—Yes, 36 miles of canal would be necessary; the difficulty is that the country there consists of decomposed quartz, and a lined channel would be required for some distance, possibly 10 miles.

10. *Q.* That is just now in abeyance?—Yes.

11. *Q.* While you are carrying on smaller ones and getting a more direct return?—Yes, this would give a fair return but for the long length of channel; there is a good site for a *bund*; the country that would be benefited is very large indeed.

12. *Q.* Is the country where you repair tanks conveniently situated, or is there much contouring?—Very little.

13. *Q.* You would consequently expect a good return to pay interest?—Yes; I think a very satisfactory return has been already received.

14. *Q.* (*Sir Thomas Higham.*)—Are these programmes got up in your department?—Yes.

15. *Q.* You have spent something on repairs; is that included in the figures of capital cost?—At present it is very difficult to make the officers keep them apart. Ready to take up for famine works we have in Gwalior 150 projects for tanks with plans and estimates complete, and 500 more are under investigation; in Malwa there are 75 tanks with estimates and plans complete, and 226 projects under investigation.

16. *Q.* (*The President.*)—Do you propose to keep them for execution during the famine?—No. These works are constructed as funds become available and further additions made to the list as plans and estimates are got out.

17. *Q.* (*Sir Thomas Higham.*)—What grant have you?—Six lakhs a year.

18. *Q.* Are you keeping to that steadily?—Yes; we have now under construction in Gwalior itself 70 tanks and 40 wells; these wells are big ones; we have nothing to do with small wells. Some of these wells cost up to Rs. 3,000.

19. *Q.* What size are they?—Fifteen feet diameter.

20. *Q.* Are they intended for watering purposes or for irrigation?—Principally for irrigation but also for giving people water.

21. *Q.* (*Mr. Rajaratna Mudaliar.*)—Do you use boring instruments in the case of these large wells?—No.

22. *Q.* These are all drinking wells?—Both for drinking and irrigation as well.

23. *Q.* Do you make irrigation wells for the people?—Yes, we are doing that largely under His Highness' personal direction; he has settled three or four wells to each village in the Bithwar district.

24. *Q.* Is there no charge made for them?—No charge is made. This money is not advanced to the people. These works are made by the State, who will get the advantage in the settlement. If, however, it is shown that the people are wealthy enough to make their own wells, they are made to do it.

25. *Q.* The cost of the well is partly Government's and partly the owner's?—Most of these wells are done under the Revenue Department.

26. *Q.* You have nothing to do with these?—We have had to do with some of the bigger ones. These wells are quite separate from ours.

27. *Q.* Do you actually make new wells?—Yes.

28. *Q.* Do the people contribute anything towards them?—No.

29. *Q.* They work them afterwards with their own bullocks?—Yes.

30. *Q.* Have you had anything to do with repairing them afterwards?—Of existing wells we have repaired a few; but, as a matter of fact, this making of deep wells has only lately started since I have been here.

31. *Q.* How long have you been here?—Two-and-a-half years. I have been in Central India for nine-and-a-half years, and all the other time on railway works.

32. *Q.* You spent six lakhs altogether on tanks and wells?—Yes. I am sorry to say I forget the figures for this year, but I remember the figures for last year; it was Rs. 64,000 for wells.

33. *Q.* (*The President.*)—How do they settle; who has to have the use of the wells? Do they settle that among themselves?—The question of revenue has always been kept distinct from the engineer's branch, so I am sorry I can give you no reliable answer to that question.

(*His Highness the Maharaja.*)—They settle that among themselves.

(*The President.*)—They don't have any disputes about it?

(*His Highness the Maharaja.*)—We have very few disputes here.

34. *Q.* How many irrigation engineers have you in this State?—We have two irrigation engineers at Gwalior itself, and one at Malwa, Mr. Judd, who has irrigation work in addition to his other works.

35. *Q.* (*Mr. Rajaratna Mudaliar.*)—In the Malwa statement you give a column showing average working expenses. In one case, No. 39, I find that the total increase in revenue is given as Rs. 120, and the average working expenses at Rs. 120. You swallow up the whole increase?—Of course all these tanks were not made on business principles: some were largely famine protective works.

36. *Q.* What working expenses can there be in such small tanks as that? I suppose the villagers can look after that?—This particular pond is for drinking-supply.

37. *Q.* How do you work out your working expenses? Is that maintenance charge?—Yes; for repairing and keeping them in order. It was not intended to be a revenue-earning work.

38. *Q.* You will find several cases where the working expenses exceed 50 per cent.?—That they do. All the tanks have not been selected in the best sites, nor are they all intended even to be revenue earning. When the works were very necessary during the famine, they had to be started, although they were not revenue-earning. I should like to point out that all the works started during the famine have either been completed or are yet in hand for completion. No works have been left uncompleted or abandoned.

39. *Q.* These are very petty tanks, irrigating from 10 to 20 acres. Don't the villagers keep them up?—At present that is not the system, though both His Highness and I desire that it should be so. At present the Public Works keep them up. *Mr. H. B. Taylor.* 11 Dec. 02.

40. *Q.* (*The President.*)—Are you advising any scheme for insisting that the up-keep of tanks should be done by the people?—I am personally of opinion that should be done.

(*His Highness the Maharaja.*)—We think a zamindar must look after it, and it must be compulsory that he should do petty repairs.

(*The President.*)—Supposing he refuses, do you propose to fine him?

(*His Highness the Maharaja.*)—Yes, and for their guidance I propose to have a few rules to show them how to protect a *bund* from damage, and when the rainfall is coming down in great floods, how they are to open the sluices, and how they are to close them: but I object to having screw sluices in villages, because they require skilled men to work them.

(*Witness.*)—We must have some Act, in case they don't, to compel them to do this. That is what I have been trying to bring forward; at present not only will they not do the repairs, but they won't even report that damages have been done.

WITNESS No. 65.—MR. K. B. JADHAVA, *Subah* of Baroda. *Mr. K. B. Jadhava.* 11 Dec. 02.

1. *Q.* (*The President*).—What is the position you occupy in the Baroda State?—I am a *Subah*.

2. *Q.* In your paper on Baroda you say in paragraph 4: "the water under the black cotton soil in Amreli is saltish, and the land, if irrigated constantly, would refuse to grow any crops. Notwithstanding this, wheat and *kamod* rice are grown under well irrigation." Is there much rice grown under wells?—Yes; when water is within 30 feet, it pays.

3. *Q.* I suppose it is a very good description of rice?—Yes.

4. *Q.* Then you go on to say in the same paragraph, "sugarcane used to be grown, but Government had to check it by a special impost of Rs. 12 per *bigha* (Rs. 2,074 per acre), as it requires irrigation throughout the year, and the salt water spoils the land." Are these wells salt in their nature?—Yes, the wells are usually not more than 30 feet deep in the black soil tracts.

5. *Q.* Then you speak of Navsari black soil; do you want much irrigation there?—Yes, on account of the *rabi* crops.

6. *Q.* Has there been any attempt in the Baroda State to make irrigation canals?—Yes.

7. *Q.* From where?—From the Orsang river. Our original idea was to bund up the Heran river and make a big lake of 18 square miles, costing 18 lakhs, in Chota Oodeypore. And if more water was found necessary, I thought of having a canal from the Nerbudda and join it to the Heran, and carry this canal to join the Orsang canal somewhere near Bhadarpur. If we can succeed to secure the site on the Nerbudda, it would of course be unnecessary to make the big lake in the Heran. Levels have been taken for some distance, and I have walked a certain distance towards the Nerbudda; from the trigonometrical map I can show that it is possible to connect the Nerbudda with this scheme. A weir has already been built on the Orsang, at Jojawa near Badarpur Railway Station. (This was all said looking over maps and plans.)

8. *Q.* Would you take your canal past Dabhoi?—Yes. That is on the edge of the black soil tract; we want to grow better cotton, or other crops if it is not possible to grow better cotton.

9. *Q.* With irrigation?—Yes.

10. *Q.* Are you going to face this question of irrigating black soil?—Yes, Baroda black soil.

11. *Q.* (*Mr. Rajaratna Mudaliar.*)—Is there well irrigation there?—Where wells can be made at a depth not exceeding 50 and 60 feet.

12. *Q.* (*The President.*)—You say in paragraph 18: "there are practically no private irrigation works other than wells, unless a few small tanks may be called so?"—Yes, they have been neglected, but now we are making a systematic survey of tanks.

13. *Q.* Is the State going to pay for the repair of the tanks?—Yes, all works are done by the State.

14. *Q.* And the maintenance afterwards?—If they are small, the Revenue Department will look after them; if big, then the Public Works Department.

15. *Q.* How many tanks will come before you in that way?—I think there will be several hundreds.

16. *Q.* Is there any feeling against irrigating black soil?—No.

17. *Q.* There is a feeling in the rest of India?—Our black soil and that of Broach is really *besar*; before 1860 much cotton was not grown; we class this as *besar*, which means black soil mixed with fine sand in some quantity; if it was really black soil only, it would crack, and if people found it unsuited for irrigation, they would not lift water 60 feet and grow onions and sugarcane on it.

18. *Q.* In some black soil they could not make wells at all?—No; the cost would be too great.

19. *Q.* (*Mr. Muir-Mackenzie.*)—The area actually irrigated in the Baroda district is, I see, exceedingly minute; 10 lakhs of acres were under crops, and the area actually irrigated was 28,000?—The cause is that where wells go beyond 60 feet people do not care to work them. The Baroda district has to be divided into three parts: (1) north-eastern strip, called *chorasi*, consisting of Savali and Vaghodia, part of Baroda and Dabhoi, where rice is grown in black soil; (2) north-western strip of Gorat soil, where there are a large number of wells, and where *bagait* or garden crops can be sown; and (3) the southern strip of black soil where cotton is grown.

20. *Q.* (*The President.*)—Until you get a correct survey of the country, can you give any opinion as to the Orsang project?—We are sure the project will be successful at very moderate expense.

21. *Q.* (*Sir Thomas Higham.*)—You have no large irrigation works in black soil?—No.

22. *Q.* What is ordinarily cultivated in black soil?—The staple is cotton to the extent of 45 per cent.

23. *Q.* If you make your big canal, do you suppose water will be taken for cotton?—No, it is not necessary that cotton should be watered; it can grow with less than 4 inches of rain. In the Chorand taluka, which adjoins Amod, in 1899 there were only 2·95 inches of rain, and yet the cotton crop was good where the people did not destroy their crops.

24. *Q.* (*Mr. Muir-Mackenzie.*)—What do you mean by people destroying their crops?—People were afraid Government would take a full assessment, and so they allowed their cattle to roam about over the crops, as they did in the neighbouring British district of Broach.

25. *Q.* (*Sir Thomas Higham.*)—Supposing you bring a canal into this district, will the people give up cotton and take to rice?—It is not necessary; they can grow sugarcane, onions, garlic, and other garden crops.

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26. Q. But the area will be very limited?—No; as it is, cotton is not grown over 45 per cent. of the area.

27. Q. What is grown on the rest?—*Juar*.

28. Q. Do you mean that if you brought in a canal, *juar* would be replaced by high class crops?—Yes.

29. Q. And cotton would remain as it is?—Yes.

30. Q. You do not think they would go in for rice?—I do not think so.

31. Q. Although it is a good crop and costs less, they won't go in for it. Would rice be more profitable than cotton?—I don't think so, because rice is not a paying crop; it is not exported on a large scale; cotton is the crop of export, and commands a better price than rice.

32. Q. If you irrigate that soil and grow high class crops, will there be any difficulty about manure?—There will be difficulty about manure, but I think the State will introduce artificial manure.

33. Q. They will have to pay for it?—They pay now in Poona something like Rs. 200 per *bigha* for castor cake.

34. Q. What is the manure that will be introduced?—There is an Agricultural Department; we shall find out from it which is the best manure.

35. Q. Referring to Appendix 7, column 8, in this statement regarding Baroda, are these actuals?—No, they are estimated areas.

36. Q. What is the basis of the estimate?—The quantity of water available in each tank.

37. Q. Do you allow so much per million cubic feet?—No; for rice there are three or four full waterings of six inches each.

38. Q. Are these all supposed to be rice areas?—Not all; certain are.

39. Q. How do you estimate the supply in your project?—From the catchment area.

40. Q. You have not the area of what you get in the hot weather?—No.

41. Q. Do these ever run dry?—These tanks are not supposed to have water in the summer.

42. Q. Your sugarcane wants water all the year round?—None of these tanks grow sugarcane.

43. Q. I thought you said the Orsang would grow sugarcane?—We are going to have a big tank on the Heran, or else store water in our own territory.

44. Q. That would be so much added to this 10 lakhs that you have in column 4?—Yes.

45. Q. That has not been estimated?—One tank on the Orsang has been included in this 10 lakhs.

46. Q. Do you want to make storage works outside Baroda territory?—All the works I have proposed are outside Baroda territory, *viz.*, the Sabarmati reservoir, the Nerbudda canal, the Marbi canal and the Heran reservoir.

47. Q. If the British Government wanted to make a tank, the site for which was in Baroda territory, would the State make any objection?—I don't think I am authorized to speak on that point.

48 Q. (*The President.*)—Have you experimented with different kinds of cotton?—Yes.

49. Q. Have you ever tried Egyptian cotton?—Yes.

50. Q. Does it succeed?—For two years only, and then it fails.

51. Q. Did you give it water?—Only a small quantity.

52. Q. In Egypt they water it every two or three years?—I wish to introduce into the State a system of side irrigation; by that system less water is given to the field, and at the same time fairly good crops are grown.

53. Q. You know the Egyptian cotton gives a very large produce?—Yes, it is 3½ times that of the Indian cotton.

54. Q. How do you account for that?—It is the poverty of the soil; there is no manure applied to the soil in India, while Egypt gets manure from the floods, and there is the lightness of the soil.

55. Q. (*Mr. Muir-Mackenzie.*)—Have you served in any other district?—Yes.

56. Q. Where does the Orsang project go?—It first passes through the *gorat* and then close to the black soil.

57. Q. Does it go past Dabhoi into black soil?—Yes, it passes by Dabhoi on to Shinor into black and *gorat* soil.

58. Q. It goes past the river Nerbudda?—It goes towards the Nerbudda.

59. Q. Then it will only pass through a small slice of black soil?—Yes.

60. Q. What do you propose to do to protect paddy?—We are going to make tanks and repair old ones.

61. Q. Is the country like Kaira?—No, it is like the Panch Mahals.

62. Q. Are the people principally Bhils?—No, a better class.

63. Q. Will they irrigate?—Yes.

64. Q. (*Mr. Rajaratna Mudaliar.*)—Is the soil in the north different from the black soil in the south?—Yes; in the north there is *kunkur* in the soil, but not in the south.

65. Q. (*Mr. Muir-Mackenzie.*)—How did the famine affect the different parts?—The paddy district was affected more than the cotton district.

66. Q. What was the reason of that?—The cotton cultivators are of a better class; we had hardly any *kunbis* and *patidars* on our works.

67. Q. (*The President.*)—Did they die?—No, they could manage to get on, but they lost their ornaments and bullocks, etc.

68. Q. (*Mr. Muir-Mackenzie.*)—It was not that there was a smaller failure of crops?—No.

69. Q. Did the census show a material reduction in the growth of the population?—About 19 per cent.

70. Q. What is your system of advancing money for wells?—The present system is to give money up to Rs. 500 free of interest; for that no security is required. Under this system Rs. 7,11,284 have been advanced within the last three years.

71. Q. Is there any difficulty about recovery?—In the past there has been no difficulty; we have very few bad debts.

72. Q. I suppose you remitted a certain amount in the famine?—I will look into that now; I don't think we shall have to remit, because wells have been properly constructed under special officers.

73. Q. What is the system?—A special officer is appointed for one or two talukas; he goes round and inspects the sites and finds out whether wells are possible; then he goes to the village and asks people whether they want *takavi*, and explains the rules; when people come forward he examines their fields and sees whether the site is favourable; then he advances money straight off for making a pit; when that is dug, he goes to it and finds out whether the water is good; if the water is good he advances up to Rs. 500 in instalments; if the well fails, or it is salt water, the first advance of Rs. 20 is struck off and not recovered.

74. Q. In that way you have given large advances?—Yes, the details are given in Appendix 8.

75. Q. The State has constructed some wells?—Yes, and a large number are being constructed by cultivators themselves under Government supervision.

76. Q. What return do you get for State wells?—In Amreli 129 wells were constructed by the State; an extra *jirayat* rate is put on; supposing a well is capable of irrigating 6 *bighas* of land, and there are 20 *bighas*, the *jirayat* rate for 6 will be spread over 20 *bighas*.

77. Q. What does it pay originally?—The rates vary from Rs. 2·11 per acre.

78. Q. When there is a well what additional amount do you put on?—If a well commands 20 acres of land, we multiply Rs. 2·11 by 6, because a well at one time cannot irrigate more than 6 acres, and spread that over 20 acres.

79. Q. How do you arrive at Rs. 2·11?—That is the dry crop rate. We charge that rate on the area which the well is estimated to be capable of irrigating, and spread the sum arrived at over the total area commanded by the well.

80. Q. (*Mr. Rajaratna Mudaliar.*)—What does a well cost in Amreli?—Rs. 250.

81. Q. With regard to what you say in paragraph 18 about pumps being put up in wells, since when has this been going on?—Since the famine, because bullocks began to die and so enterprising people who wanted pumps were given an advance.

82. Q. What is the result?—People are pleased with them and are continuing to use them.

83. Q. How many are there?—Fifteen.

84. Q. Are you able to irrigate large areas?—Yes, one irrigates 200 acres; the machinery cost Rs. 15,000.

85. Q. Does the man pay wet assessment?—Not for 30 years.

86. Q. When the Durbar is putting up engines at its own cost does it not levy a water-rate?—No.

87. Q. Is the cost of working less than bullock rate?—Where there are 6 *Los* or less bullock power is more economical.

88. Q. How long do your wells last?—*A pakka* well about 100 years.

89. Q. And *kachcha* wells?—It depends on the locality; in Kadi they last from 5 to 12 years, and some for only a couple of years; they are lined with grass and creepers.

90. Q. In paragraph 23 you give the average area irrigated per well; does that represent the area of one crop or both?—One.

91. Q. Do most wells irrigate more than one crop?—No.

92. Q. What is the object of charging differential rates of interest as stated in paragraph 26?—That is the old system; we have discarded that; our present system is explained in paragraph 28.

93. Q. You say in paragraph 29 "a system similar to the Madras system of advancing *takavi* for wells on the security of the well and the land under it up to Rs. 750, recoverable by an additional charge on the land for a long period, has recently been introduced in some parts." Do the people like the permanent addition to their rent?—The measure has just been introduced, and only 229 wells have been made; the people appear to like it, but they require to get accustomed to it. In course of time they may do so.

94. Q. Probably that will depend on the amount of the addition?—Yes.

95. Q. In Baroda do they like it?—It has not been yet tried; an officer has been transferred to Kadi to see if the people will take to it.

96. Q. You say in paragraph 36 that field embankments are suitable for relief labour. Was this resorted to in the last famine?—Only on a very small scale.

97. Q. Do you think it will be possible for the State to supervise the construction of these field embankments?—No, it is not possible; if cultivators want to do this work, they can do so by taking *takavi*, but Government cannot undertake it.

98. Q. From Appendix I it appears that in Navsari the area irrigated by wells in the famine year fell to 4,636 from 12,319 in a normal year; the decrease appears very high as compared with other districts; what is the reason?—Because they irrigated *kharif* crops, which are not shown; they did not care to irrigate *rabi* afterwards; they went on irrigating *juar*, cutting it down and selling it,—one stock would fetch a piece,—and then they irrigated for fresh shoots; that paid better than any other crop.

99. Q. The decrease was not due to failure of wells?—No.

100. Q. There is a footnote to Appendix 8 as follows:—"In Amreli 129 wells have been constructed by the State at a cost of Rs. 95,727." Don't you think the average cost, which works out to about Rs. 740, is rather high?—Yes.

101. Q. What was the reason of that?—It was done by Government and so all labour had to be paid for, while an ordinary cultivator gets his people and neighbours to work, that is not calculated.

102. Q. Could not the cultivator construct wells more economically?—Yes, I think he could.

103. Q. (*Mr. Muir-Mackenzie.*)—Was there any part of the State in which they made *kachcha* wells largely in the famine?—In Kadi they did.

104. Q. They saved their cattle thereby?—They could not save much of their cattle, but they got some wheat crop.

105. Q. (*Mr. Rajaratna Mudaliar.*)—You referred to some high class crops in the early part of your examination; what is the description of crops?—Sugarcane. Under the present system of irrigation what happens is this: when cultivators get water from the canal, which costs them rather less than the well water, they don't mind wasting a little more water, and the result of that is the cultivators use four to five or sometimes ten times more water than the land really requires. I have found that to irrigate one *bigha* of land of ours, 160 feet by 160 feet, it requires one pair of bullocks for two days, drawing daily about 450 *kos*, each containing five maunds of water; that is to say, 900 *kos* of water for each watering. Now I have been noticing in Southern India that the people use much more water than this. They used 900 *kos* of water in the beginning under well cultivation. But after four years of canal waterings the crops began to fail, and the reason was that the soil got chilled. Now this is a very important question. I have been thinking of introducing irrigation works in the Baroda State, and I find that the present system of giving water from the canal results in a wanton waste, and what we want to do is to show the people a system by which they cannot take more water than we like to give them. That system is not to give them more water than what they take under well irrigation. If a well has not more than two *kos*, then the cultivator makes something like 400 *bits*, what are called *charas*; and if he has a larger quantity of water, he makes about 300 or 350 *charas* in one *bigha* of land. Now even that system I call a wanton waste, but what I do is this: I don't make *charas* myself; I simply make a small channel every three or five feet apart, and that channel is ten inches deep and nine to ten inches in width. I fill that channel only, and allow the water to go into the field by percolation. I tried this system and, side by side, I had ordinary well irrigation, and I found that under my system I required less than half the quantity of water. I used 40 to 50 per cent. less than I used with well irrigation, and my crop was better than the ordinary crop.

106. Q. (*The President.*)—How much will it cost you per *bigha* to do this?—The manual labour is much less and the profits are greater.

107. Q. Have you discussed this at all with Mr. Mollison, Director-General of Agriculture?—No, I have not the pleasure of knowing him. After giving the water in this manner on the surface soil, what happens is this. I can cultivate one *bigha* of land in much less time than under the well irrigation system, because under the well irrigation system the soil gets caked, while in the case of my system the soil remains on the top perfectly friable, so my pair of bullocks can do one *bigha* of land in one day.

108. Q. You mean that you fill the furrows?—Yes, and they are at a distance of three feet apart.

109. Q. (*Sir Thomas Higham.*)—Your furrows, you say, are nine inches deep?—Yes.

110. Q. (*Mr. Muir-Mackenzie.*)—Do you make them with the plough?—No. (Illustrates how it is done.) The advantages are so many that I require a less quantity of water, and my cost of cultivation is less, and I also get a better crop.

111. Q. (*Sir Thomas Higham.*)—Have you tried this with well irrigation?—Yes.

112. Q. Are the furrows always three feet apart?—Yes; I first tried six feet and failed; then I tried five feet and failed; then I tried four feet,—that was fair; and I succeeded with three feet.

113. Q. You never allow the water to run off?—No; I fill these furrows once in four days, until the soil is well saturated, then once in seven days.

114. Q. All through the crop?—Yes, during the watering season.

115. Q. How long does it take for the water to percolate out of the furrows?—If the soil is light, a furrow empties half an hour after it has been filled.

116. Q. This is not in black soil?—With black soil what happens is this. In the beginning it takes a very long time to reach the other end of the field on account of the numerous cracks, but when that end is filled, it takes about an hour or a little more than that for the water to disappear into the soil, and then it is all right.

117. Q. When do you repeat it again?—We see the condition of the soil and repeat it again, seven or ten days after.

118. Q. (*Sir Thomas Higham.*)—It seems to me you give as much water in this way as in the other way?—No, I won't.

119. Q. Every watering you give, if spread over the soil, would be three inches on the soil?—It might be.

120. Q. If you give it a watering every four days, that would mean a good deal; would not it?—Watering is given only when it is wanted, and not otherwise.

121. Q. You find in practice it requires it in four days?—In some crops which require to be grown very rapidly. For instance, *juar* does not require it more than once in fifteen days, and tobacco requires only one watering.

Mr. K. B. Jadhava.

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122. *Q.* (*The President.*)—Have you any thought of laying this before Mr. Mollison?—I have not that idea.

123. *Q.* (*Mr. Muir-Mackenzie.*)—How are you going to get your cultivators to adopt it?—That will be a matter of paternal autocracy.

124. *Q.* (*Mr. Rajaratna Mudaliar.*)—Your system won't do for rice cultivation?—No, it is not meant for rice cultivation. This is meant to prevent water-logging; for rice cultivation you require a large quantity of water.

125. *Q.* Don't you waste a large area under your system?—Not at all. In yield I have not suffered at all. I want to ensure Gujrat against famine. Every third year is a bad year, but still Government has been collecting revenue; if the rain in September fails, the crops fail also. I want to utilize the Sabarmati; there is a fine site available, but it belongs to a Thakur; the catchment area is 1,000 square miles, and the rainfall is 40 inches; I want to catch the flood waters only, and so we shall in no way deprive Ahmedabad. If we can construct a tank (site indicated on map), we shall benefit not only Kadi, but certain districts of Ahmedabad; thus, if the cultivator is ensured his *kharif*, he will not be so badly off. Even if we don't get rain in September there will be ample water in the tank for one watering, which is enough for rape and *bajri*; rape is very valuable, and Government collects its revenue on it. Then, again, I have an experimental measure for a submerged dam (site indicated). The Saraswati shifts its course every now and again, so this course would be useful. Wherever there are such rivers there should be submerged dams. The Kadi district is well watered, and even if they got one or two waterings, that would answer all purposes. There are very favourable sites for tank work. We have constructed as an experimental measure one tank at Kadarpur costing four lakhs. In giving water to this region we want to do something that will suit our requirements and those of the cultivator. Near this tank there are wells with water at 20 feet depth, but 9 to 10 miles away water is not easily to be had; there you go to 70 and 80 feet, and then there is not sufficient water; we don't want to give water where there are wells, but only to those places which are in great need. We want always to keep much more land at our command than the tank water can irrigate, so that we can go on with side irrigation (furrow). We want the co-operation of the British Government in the matters of making irrigation works outside our territory and that especially for the Sabarmati scheme.

WITNESS No. 66.—MR. J. R. CHICO, Acting Chief Engineer, Baroda State.

Mr. J. R. Chico.

11 Dec. 02.

1. *Q.* (*The President.*)—You are in the Public Works Department, Baroda?—Yes, I am at present acting for the Chief Engineer who is away on leave.

2. *Q.* Have you a long and intimate acquaintance with Baroda?—Yes, I have been there about 16 years.

3. *Q.* We had evidence this morning about the proposed Orsang Canal?—That is what I have got here on the table now. (Shows plans to the Commission.)

4. *Q.* Our Commission is not going into close technical details about it, but one of the first things we would like to know is whether the levels are suitable for carrying out the canal?—They are. The level of river bed here is 205·15; the top of weir, 211·15; and the bed of canal, 207·00. (Explained on map.)

5. *Q.* What are your discharges in this river?—We get 140 cusecs.

6. *Q.* What have you in different months of the year? What have you in the monsoons?—In the monsoons we have 19,000 feet coming down in the floods.

7. *Q.* What have you in the month of October?—We expect 140 in the month of February. For the last two years we got in the month of November to 30 cubic feet, and this year we have come down to 6 cubic feet only.

8. *Q.* How much of the work is done in the whole canal?—Only the weir is done.

9. *Q.* You have not made the canal yet?—The weir and head-works have only been done.

10. *Q.* If you only get 6 cubic feet, how are you going to get a supply?—We are going to bring it from the other river. (Explained on the map.)

11. *Q.* What is your irrigation to be?—Chillies, onions, and *such crops*.

12. *Q.* How many cubic feet do you calculate on getting from this Heran river?—140.

13. *Q.* It is a larger river than the Orsang?—Yes, larger in discharge.

14. *Q.* Have you got enough observations to be certain about that? You were mistaken about the Orsang, you know?—We took the discharge last year, and it was taken for this year, but we are not in a position to say until several years have passed.

15. *Q.* You are keeping a gauge?—Yes. What we have proposed to do is to have storage from the monsoon water of 500 million cubic feet in this very canal.

16. *Q.* Is there any irrigation to be done in the valley of the Heran?—No.

17. *Q.* Can you tell us anything about the Nerbudda levels?—We have not taken any.

TWENTY-FIFTH DAY.

(Of sitting in 1902.)

Gwalior, 12th December 1902.

WITNESS No. 67.—MR. N. C. O'GORMAN, State Engineer, Dhar State.

Mr. N. C. O'Gorman.

12 Dec. 02.

1. *Q.* (*The President.*)—You are an engineer in one of these small States?—At present I am employed by the Dhar State, but from the 1st of April next I will be attached as Engineer to the Bhopal Agency. I am sent here, however, to represent Alirajpur, Jhabua and Jobat States.

2. *Q.* You know all about these States?—Yes. I have toured through them.

3. *Q.* Might I ask who prepared this paper?—It was prepared by the different officials of the State combined together.

4. *Q.* I see it is said here "if the black soil is not more than four feet in depth, it is good for irrigation." Have you any personal experience of that?—I have not.

5. *Q.* I gather these States until this last famine considered themselves immune from famine?—I don't think they have had any famine for years. There has been some scarcity, but no famine.

6. *Q.* Does Dhar go right down to the Nerbudda?—Yes. It has a fringe of 10 or 12 miles to the Nerbudda, and extends south some 15 miles.

7. *Q.* Is the Nerbudda very deep there?—It varies according to the season. The general average is about 12 feet depth of water, and the maximum 80 feet.

8. *Q.* Is the valley of the Nerbudda deep below the country?—Yes, very deep. The Nerbudda itself is on an average 60 to 80 feet below the surrounding country. The only way to get water from the Nerbudda to irrigate is from pumps, and that only in some places, because the land drains up from the Nerbudda for miles. It is only in some places you get flat country.

9. *Q.* Does Dhar touch upon Baroda?—No. I don't think so. Dhar is practically surrounded by Gwalior and Indore States on one side, and Indore on the other.

10. *Q.* What do people feel about the wells there?—The people prefer irrigation from wells to anything else. There are numbers of wells in Dhar State.

11. *Q.* The number given here is 2,983. Is the number of wells on the increase?—Yes. Every year they make wells.

P 12. *Q.* (*Mr. Muir-Mackenzie.*)—*Kacheha* wells, I suppose?—Most of them are *kacheha*. They always try and make them *pakka*. If the well turns out good, it is usually made *pakka*.

13. *Q.* (*The President.*)—Does the Durbar give them any encouragement to make wells? Does it give them any advances? You say in your note "whoever builds a new *pakka* well will have one *tigha* in every six *bighas* of irrigated land as *oosar*?—Yes. He does not pay for that.

14. *Q.* You go on to say "amount of loans advanced to cultivators for construction of wells during the last ten years is Rs. 13,032," that is, Rs. 1,300 a year, and I suppose a well costs about Rs. 300?—About Rs. 350.

15. *Q.* That means about four wells in the year?—Yes.

16. *Q.* At the end of the new works proposed you have a number of small works which will bring in 2,149 acres under irrigation. Are any of these in hand now?—None of these are in hand yet. The cost of them will be about Rs. 2,50,000.

17. *Q.* Have you got designs of these yet?—They are not designed yet.

18. *Q.* Did you compare this list, or was it done by the Durbar?—It was done by the Durbar. I only joined the State about three months ago.

19. *Q.* You cannot tell us anything about these projects?—Nothing, except that I have seen the sites for some of them of which the bunding of the Porar river is one and the bunding of the Kukshi river is another.

20. *Q.* Do these rivers run dry?—Not the rivers we are going to bund; they run the whole year, except Kukshi river.

21. *Q.* Do you take the discharges of them?—I am going to take the discharges later on.

22. *Q.* Have you got gauges up these rivers?—Not at present. There is only about a foot and a half or two feet of water in them.

23. *Q.* (*Sir Thomas Higham.*)—The principal means of irrigation in Dhar State appears to be by wells?—Yes. It comes natural to them to irrigate from wells.

24. *Q.* Is the number of wells increasing very much?—Lately it has been increasing very fast.

25. *Q.* Do wells ever give out in dry years?—Some of them gave out this year and they have all been deepened, and we got water through the summer months this year by deepening them.

26. *Q.* (*The President.*)—Are the wells through rock?—Most of them always have a rocky foundation, and you pierce the rock and get water below.

27. *Q.* (*Sir Thomas Higham.*)—Have they deepened any wells with a view to getting more water?—Most of the wells have been deepened this last summer.

28. *Q.* Did they get a better supply?—Yes. In one or two places the rock was bored 12 inches to two feet diameter as a sort of trial, and as soon as we pierced the rock, we got the water from below.

29. *Q.* I suppose they have not always been successful?—Not always. Sometimes we have bored as far as 20 feet and we have not got through the rock.

30. *Q.* How do the people make wells? Do they take advances or do they make them out of their own pockets?—Most people go on the idea of some one showing them by signs where the wells would be. They are led by some one who is supposed to have some powers of knowing where water can be found.

31. *Q.* What do they use?—Nothing at all. They only go by some astrological phases.

32. *Q.* When a man wants to build a well does he take a *takavi* advance or does he build it out of his own pocket?—I could not be quite sure of that. The State does make advances through the *Kamardars*, but I am not quite sure how it is done.

33. *Q.* Does the State make any wells itself for the people?—During the late famine they made a number of wells.

34. *Q.* They were made by relief labour?—Yes.

35. *Q.* What were the relief works?—They were roads, tanks and wells.

36. *Q.* How did they employ this labour on wells? You cannot get much labour on to a well?—There were a number of men put on to excavate the well; on each well you got about 50 men to work. The wells were made about from 8 to 15 feet diameter.

37. *Q.* Did they put any masonry into them afterwards?—If the wells turn out good wells, they always put masonry into them.

38. *Q.* And the tanks that were made in the famine, were they completed?—Most of them. There were six tanks at Darampuri which were all completed. The tanks are perfectly full now and are used.

39. *Q.* Are the tanks used for irrigation?—They will be used now for irrigation.

40. *Q.* Have they filled?—Most of them have completely filled.

41. *Q.* Have they got waste weirs?—They have all got waste weirs and sluices. In three or four village tanks only they did not put in waste weirs or sluices.

42. *Q.* How do they draw water off from the irrigation tanks?—They have got sluices.

43. *Q.* Are any of these works remaining to complete now?—Only just dressing,—nothing more. The masonry is all completed.

44. *Q.* You say you never make field embankments?—No. The natives don't seem to know how to make them. The Political Agent wanted to try field embankments in the beginning of this year, but I don't think the experiment was made. When I started here he asked whether field embankments would not do, and as the natives did not know anything about field embankments, they did not like to try it.

45. *Q.* Do you know of any reason why they should not be beneficial?—None at all. I rather think in places they would be beneficial.

46. *Q.* (*Mr. Muir-Mackenzie.*)—What are the cultivators like in Dhar?—In Dhar there are some very good descriptions of cultivators called Koombhees, Sirvis, Malis, Jats and Rajput, respectively.

47. *Q.* Do they form the majority of the cultivators?—Yes.

48. *Q.* You have not many?—Yes, in some parts.

49. *Q.* In Alirajpur State and Jhabua they are nearly all Bhils?—Yes.

50. *Q.* Were there not wells made in Alirajpur and Jhabua?—In Alirajpur they were nearly all wells, and in Jhabua tanks.

51. *Q.* Did the Bhils make the wells?—Yes.

52. *Q.* Have the Bhils been induced to take to well irrigation?—They don't like anything which involves labour.

53. *Q.* Has it been found impossible to induce them to take to it? By letting them off dues do you think they can be induced to take to well irrigation?—I think so, but they could be induced by encouragement.

54. *Q.* What sort of dues are they? Is it this additional revenue?—No: this system does not prevail in these States. Only those who show an aptitude for agriculture will take to it, whether taxed or not. In Jobat some Kashais were introduced to set Bhils an example in agriculture.

55. *Q.* You think if they could be exempted from that, they would take to well irrigation?—That is my opinion.

56. *Q.* Is not it very difficult to induce the Bhils to settle down in any one place?—Not if they have a good place unless there is something like sickness there. They run away then, not otherwise.

57. *Q.* Did you ever hear of an experiment made by Mr. Bosanquet to introduce cultivators from other parts among them to set them an example?—No, I did not hear of that.

58. *Q.* These tanks you spoke of, you say they filled very well?—They have not filled normally at present, because the earth seems to have taken in an immense amount of water. They fill perfectly and then the water seems to percolate away.

59. *Q.* You hope they will fill in an ordinary year?—We hope this year the land being fairly well saturated that next year they will fill perfectly.

60. *Q.* In the year 1899-1900 in some of your States you only had six inches of rain. Do you think they would have been well filled in a year like that?—I do not think so, though a portion would have remained over from the previous year, because for the irrigation from these tanks all the water would not have been taken out.

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61. *Q.* Not with the irrigation of the year before?—I don't think so, because we have rain in December, January and February, and it is only for opium they want irrigation in the hot weather.

62. *Q.* But you only get two inches of rain in January and February altogether?—I could not say the amount in inches, but it is quite sufficient for the crops of that season.

63. *Q.* And is that sufficient to empty the tank?—No. The tank is filled by the rains.

64. *Q.* Is not the water all taken out of it during the *rabi*?—We are only just trying with the tanks now.

65. *Q.* So that you hardly know yet?—We hardly know, but I am going on former years when they have had splendid crops without the tanks.

66. *Q.* You rely upon the fact that the tanks will not be used in an ordinary season?—Yes.

67. *Q.* Is *kans* grass a trouble in the Dhar State?—I could not say that.

68. *Q.* You don't know the terms on which the State builds wells?—There are three ways in which State money is employed: (1) by *takavi* advances; (2) meeting the whole cost and assessing the water; (3) meeting part of cost where well is chiefly used for drinking purposes.

69. *Q.* (*Mr. Rajaratna Mudaliar.*)—Where are your tanks? Are they in the plains or in the hilly tracts?—In Malwa provinces the tanks are in plain country. The whole of the Dhar State, practically, is undulating country except the Nimar valley and some parts of Malwa, and the tanks are at the foot of the hills to irrigate the plains.

70. *Q.* Were they formed by excavating the bed or by simply bunding up the nullahs?—Some by bunding up the nullahs and some by excavation. The land is sloping down, and each side has a slope, and they have a semi-circular *bund* on the lower side, so that the excavation deepens that tank.

71. *Q.* Do you happen to know how long a *pakka* well lasts, and also how long a *kachcha* well lasts?—*Pakka* wells usually last two or three generations. *Kachcha* wells sink after a few years. It depends on the capacity of the well. Most wells have small capacity. There are some *pakka* wells in Dhar, lasting for years and years; some of them are at least 300 years old.

72. *Q.* The average area irrigated per well does not seem to be very high?—The average area is 2½ *bighas*.

73. *Q.* What is your *bigha*?—⅔ of an acre.

74. *Q.* In some districts we were told that a *pakka* well can irrigate as much as 10 or 15 acres. Such wells don't exist in the Dhar State?—Each of the *aharas* in a well can irrigate about six *bighas* a year. It just depends upon the well, how many *aharas* can run at the same time.

75. *Q.* Do they raise more than one crop under a well?—In most cases one crop is raised, but the better class of cultivators often raise two or three crops. They can raise as many as the well keeps water for. The point is, one man can, just as it were, keep six *bighas* of land under irrigation. He cannot do more than that.

76. *Q.* (*The President.*)—You are also connected with Alirajpur and Jobat?—I toured through them in the famine.

77. *Q.* Are you employed by them now?—I will be from the 1st of April.

78. *Q.* Do you know Jhabua? It is a Bhil country?—Yes, entirely Bhil.

79. *Q.* I see from the list that during the past 30 years the number of irrigation works constructed is 105, and the approximate cost of their construction, including the cost of subsequent improvements, but excluding the cost of ordinary repairs, is Rs. 27,667. Besides, this year they have constructed eight tanks, costing something like Rs. 90,000. Do the Bhils use the water out of the tanks?—Yes, the *Kamardars* make them use it.

80. *Q.* And the Bhils don't run away and disappear?—No; not if properly managed. I don't know how they do it. That matter is mostly settled by Captain Barnes, Political Agent.

WITNESS No. 68.—MR. DEO NATH SAHAI, State Engineer, Burwani.

Mr. Deo Nath Sahai.

12 Dec. 02.

1. *Q.* (*The President.*)—Are you a native of Burwani?—No. I belong to the United Provinces—Gorakhpore.

2. *Q.* Have you been long in Burwani?—I have been there more than three years.

3. *Q.* Were you there in the last famine?—During the 1899 famine I was there.

4. *Q.* Did you prepare this paper (shown)?—It was prepared by the local officials in consultation with me.

5. *Q.* I see in this paper it is stated that the population of Burwani is 76,886, and if you look at the last question the population given in 1868 was 26,611 and in 1878, 30,830. Has the population increased from 36,000 to 76,000 in 30 years?—In the 1891 census it was 80,000.

6. *Q.* Did the Burwani State have any new territory added to it?—No.

7. *Q.* Then these figures must be wrong, I think?—No. They are correct. This is according to the last census that the population is 76,000.

8. *Q.* Then do you think the figures for 1878 are correct? Do you think it is possible that the population could more than have doubled itself since then?—I cannot say anything about that. At that time (1878) the population of the State was very scanty, and since then it has gone on increasing. In 1891 it was 80,000.

9. *Q.* (*Mr. Rajaratna Mudaliar.*)—Was there much emigration?—Yes, lately there has been a good deal from Alirajpur and other districts.

10. *Q.* (*The President.*)—Is the soil very good there?—In Pansemal, Auger and Rajpur Parganas it is very good.

11. *Q.* In the first answer you say the gross area of the State is seven lakhs and odd of acres, of which only two lakhs and odd are cultivated?—Yes. The rest is all jungle.

12. *Q.* You have not got very much well irrigation? I see it is put down as 1,012 acres in the ordinary way?—We have got about 66 wells. They are not all for irrigation; most of them are for irrigation.

13. *Q.* Do the people want more wells?—Yes, they do, especially in the hills, where we cannot provide them with any other irrigation works.

14. *Q.* Do these Bhils make wells?—They do sometimes.

15. *Q.* And use them afterwards?—Yes, they do use them now, though they did not before.

16. *Q.* Why do they do it now?—They know the advantages of irrigation now.

17. *Q.* Since the famine?—Yes.

18. *Q.* Do you think they are changing their notions—these Bhils?—Yes, they are.

19. *Q.* Do other castes settle among them, or are they all by themselves? Do the Koombhees mix with them at all?—The Koombhees are only to be found in the plains, not in hills.

20. *Q.* Are the Bhils altogether in the hills?—Yes, in jungly country.

21. *Q.* Are your people in the Durbar doing anything to encourage well irrigation?—They advance money to cultivators.

22. *Q.* On what terms, do you know?—I think it is recoverable in ten years or something like that. It is mentioned somewhere in this paper. The amount of loans advanced by the State during the past ten years was Rs. 34,545.

23. *Q.* That is, about Rs. 3,500 a year?—Yes.

24. *Q.* Can you tell me anything about the State irrigation works? You have got a statement here of a number of Burwani tanks. Did you prepare this statement?—Yes.

25. *Q.* You know it is correct?—Yes.

26. *Q.* In regard to these works you say the protective results are 213 *manees*. What are these?—12 maunds make a *manee*.

27. *Q.* It is a weight of grain?—Yes.

28. *Q.* Take the first of these tanks,—the Burwani tank. You put down the cost of it at Rs. 17,000, and it yields about Rs. 280 a year. What is this irrigation—*rabi*?—*Rabi*.

29. *Q.* What is it?—Wheat.

30. *Q.* Are these tanks being finished now? There are a good number here marked "incomplete"?—No. They will be taken in hand now.

31. *Q.* What are you waiting for?—We had no money.

32. *Q.* (*Sir Thomas Higham.*)—I see you charge for water by the hour?—Yes. Rs. 1-8 is the average charged for 24 hours per *bigha*, but it is only taken in the day time.

33. *Q.* Where is it taken from?—Either from tanks or from streams.

34. *Q.* How much water do they take in the hour? How do you regulate the quantity of water they take?—We don't keep any measurement for that.

35. *Q.* You say they pay Rs. 1-8 for 12 hours?—When the field is fully saturated they pay Rs. 1-8. Sometimes they take water only for 12 hours, and when the field is fully saturated they pay Rs. 1-8 for 24 hours.

36. *Q.* You say when the field is fully saturated you then don't charge them on the area, but for the time they are taking water?—Yes.

They generally take four *bighas* in 24 hours?—Yes.

37. *Q.* They don't take the water at nights?—Sometimes.

38. *Q.* What is your *bigha*?—1½ *bighas* make one acre.

39. *Q.* Do several cultivators take it for an hour each?—I cannot say that.

40. *Q.* Who charges, then?—This is all done by the *Kamardars*—by the revenue officials.

41. *Q.* You don't know how you made them charge?—It is done by revenue officials.

42. *Q.* Have you anything to do with the revenue officials?—Nothing.

43. *Q.* What is your position?—Public Works.

44. *Q.* What is your proposal about lifting water from the Nerbudda?—This is the drawing I prepared which you have seen. It is not complete yet, but we think that irrigation is possible by pumping water from the Nerbudda in that tract.

45. *Q.* Are you making a pumping station there?—Not yet.

46. *Q.* Have you made any estimates for it?—Not yet. The project is not complete yet.

47. *Q.* What is the idea?—I am negotiating with John Fleming and Co.; they will charge about Rs. 25,000 for fixing machinery.

48. *Q.* What size pumps?—Two centrifugal pumps.

49. *Q.* What diameter?—Nine inches, I think.

50. *Q.* They will give about 45,000 gallons an hour each?—No; altogether we want 45,000 gallons an hour.

51. *Q.* How much do you suppose you would irrigate?—It will come to about 2,000 acres only.

52. *Q.* What is the depth you consider you would have to lift the water?—The lift will be above 95 feet.

53. *Q.* These works that have been completed, when were they completed?—Long ago, before I came. This Burwani tank was completed long ago. This Chunbhati was done only last year.

54. *Q.* (*The President.*)—They are all small tanks?—Yes.

55. *Q.* (*Sir Thomas Higham.*)—The financial results, are they what you have actually obtained, or what you have estimated for?—This is done by the revenue officials.

56. *Q.* Did you make out this statement?—They consulted me in the preparation.

57. *Q.* In regard to these works that are not completed, are you going on with them now?—They will be taken in hand now.

58. *Q.* Have you got money for them?—Yes, now we have.

59. *Q.* Is there anything you want assistance or advice from engineer officers about?—There is the Nerbudda scheme which we will have to consult a competent engineer about.

60. *Q.* (*The President.*)—Are you a Roorkee man?—Yes.

61. *Q.* Where were you before you joined this State?—In Hyderabad.

62. *Q.* You had nothing to do with irrigation in Hyderabad?—No; I had to do with buildings and roads.

63. *Q.* (*Mr. Muir-Mackenzie.*)—Was the famine of 1899-1900 very severe?—Yes.

64. *Q.* Did you lose many people?—Most of them died from cholera, and some from starvation too. A good many emigrated in that year.

Mr. Deo Nath Sahai.

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65. *Q.* Who suffered most?—The Bhils.

66. *Q.* They all live in the jungles?—Yes.

67. *Q.* There is a great deal of forest there?—Almost all forest.

68. *Q.* Very little cultivation?—Yes.

69. *Q.* You got a few of these Bhils to make wells; did you?—Yes.

70. *Q.* In the middle of the forest?—Just in the valleys in the middle of the forest.

71. *Q.* Did the cattle suffer very much?—Yes.

72. *Q.* Was there no fodder or no leaves for them to eat in the forests?—It was all exhausted.

73. *Q.* How did the people try to save their cattle?—Whatever fodder they had they used, and then for some time the cattle lived entirely on leaves.

74. *Q.* And when they got exhausted?—Very few cattle were left after the famine was over.

75. *Q.* Did they not try to feed them with crops raised from wells?—No. There was not enough water in the wells that year.

76. *Q.* Did they not make deep wells?—No. In that year all the relief work was roads and tanks. They did make some wells too.

77. *Q.* Is Burwani part of Bhopawar?—Yes.

78. *Q.* Were you under Mr. Bosanquet?—Yes.

79. *Q.* Did you not hear anything about his making the Bhils make wells to save their cattle?—He did try in Jobat State and Alirajpur.

80. *Q.* Jobat was not under him?—It was in that year, and Alirajpur too.

81. *Q.* Did he bring in any cultivators from outside to show the Bhils how to make wells?—I don't know that.

82. *Q.* At any rate he made some wells?—Yes.

83. *Q.* Were they at all successful?—Yes.

84. *Q.* What sort of crops did they grow?—Wheat and sometimes also *bajri* and maize they irrigated from wells.

85. *Q.* They did not particularly grow fodder crops for the cattle; did they not?—No.

86. *Q.* Are these wells still being used?—Most of them.

87. *Q.* By the Bhils?—By the Bhils themselves.

88. *Q.* The Bhils are not ordinarily very fond of wells; are they?—No, but they have learnt to take advantage of them since the famine.

89. *Q.* Only a very few of them I suppose?—Yes; the number is increasing now.

90. *Q.* Have more wells been made by the Bhils since the famine?—Yes; every year they make wells now.

91. *Q.* How many have they made altogether?—I cannot say.

92. *Q.* Are the wells under you? Have you anything to do with them?—They are by revenue officials.

93. *Q.* You have nothing to do with them? You don't select the sites?—No.

94. *Q.* You don't advise them where to make them?—Yes, sometimes I do.

95. *Q.* (*Mr. Rajaratna Mudaliar.*)—You said the wells failed in the famine year?—Yes, in the hills.

96. *Q.* I find that in the drought year wells irrigated 1,338 acres against a normal area of 1,000; how do you reconcile that with your statement?—These wells were only in the plains, not in the hills.

97. *Q.* Last year they failed?—Yes; this year there was not much water.

98. *Q.* How deep are the wells?—30 to 40 feet.

99. *Q.* In the famine year did they deepen wells?—Yes, both departmentally and by cultivator's own labour.

100. *Q.* Did they succeed in getting to the springs?—Not always.

WITNESS No. 69.—MR. BALWANT RAO SINTRÉ, Revenue Officer, Indore.

Mr. Balwant Rao Sintré.

12 Dec. 02.

(*To the President.*)—In Indore black soil is irrigated for opium and sugar-cane only, not for wheat and *chenna*, which do not require irrigation. Black soil, if irrigated, must be manured. The Irrigation Department recently formed will first restore old irrigation works. The great decrease in the population of the State is due chiefly to cholera and fever, and occurred principally in Rampura There are some small tanks. Two hundred and seventy tanks are in good condition and used for irrigation, and 400 require repairs. Wells are the most useful form of protection: they gave water when the tanks failed. We have sent for boring tools for trial borings.

WITNESS No. 70.—MR. C. A. RIBIRO, Engineer, Indore.

Mr. C. A. Ribiro.

12 Dec. 02.

1. Q. (*The President.*)—Are you a Divisional Engineer?—Yes.

2. Q. Have you been long in your post?—This is the fourth year.

3. Q. Were you there during the famine?—Yes.

4. Q. Did you suffer very much?—There was no real famine in 1901; the 1899 famine was a bad one. The year 1901 was bad on account of the previous famine.

5. Q. (*Sir Thomas Higham.*)—Was much money spent on the repairs of old tanks?—Not much.

6. Q. How much was spent this year?—We are spending two lakhs, excluding staff.

7. Q. Are disused tanks abundant?—Yes, some have silted up and in some the sluices are not in proper order.

8. Q. What are you going to do if a tank has silted up?—Clear it and repair the masonry work.

9. Q. Do you clear the silt away?—We did in some cases in the famine.

10. Q. What was the cost of clearance?—Rs. 3-12 per thousand cubic feet.

11. Q. Are there many tanks out of use?—12,000 irrigation works are out of use. We are not going to take them all in hand at once, but only those which are likely to pay.

12. Q. How much is being allowed for that?—Two lakhs for the present.

13. Q. Are these tanks in black soil?—They are mostly in black soil; some are in yellow soil.

14. Q. As regards those in black soil, what do they irrigate?—Wheat chiefly; also opium and sugar-cane.

15. Q. Do they want water?—Wheat requires two waterings after the rains; the plants that require waterings are opium and sugar-cane.

16. Q. (*Mr. Muir-Mackenzie.*)—Are you going to have charge of the repair of wells?—Yes.

17. Q. How many are in disrepair; can you say?—10,600.

18. Q. Are they entirely disused?—No, not entirely, but they are of no use for irrigation.

19. Q. Were they constructed in the first instance for irrigation?—Yes.

20. Q. What are the reasons of their becoming disused; decrease in the price of opium?—That is one of the reasons.

21. Q. What are the other reasons?—The falling-off of the population.

22. Q. Do you think till the population increased there is not much chance of the wells being used?—Yes, and we will then begin with the most promising ones.

23. Q. What plan are you going to follow; is the State going to provide the money?—Yes.

24. Q. Is there any idea of advancing money to the people themselves?—No; many of the wells are State property.

25. Q. How are you going to recoup yourselves?—By increased rates.

26. Q. Do you propose to repair these wells by Public Works labour or are you going to give it to the rayats to do?—By Public Works labour.

27. Q. Would it not be much cheaper to give it to the rayats?—I don't think so, and the work would not be done well.

28. Q. Are they big wells?—They are generally 12 feet square or 8 feet in diameter.

29. Q. Is it not necessary to build them up *pakka*?—Not generally.

30. Q. Do they go through hard material?—Very few do.

31. Q. Are they built with bricks?—They are mostly of stone; there is a great deal of stone about.

WITNESS No. 71.—LALA RAUSHAN LAL, Superintendent, Narsingarh State.

Lala Raushan Lal.

12 Dec. 02.

1. Q. (*The President.*)—Did you suffer much in the famine of 1899?—Yes.

2. Q. Have you done anything since then to prepare for another famine?—We have been drawing up programmes of relief works, but no surveys have been made, nor have any estimates been prepared.

3. Q. If you had a famine, would you be better prepared to meet it?—No, just the same; we don't know what works to take up.

4. Q. You have 9,251 acres of well irrigation in a normal year?—Yes.

5. Q. Do *kachcha* wells last well?—Yes, they generally last well.

6. Q. What is the average cost of a *kachcha* well?—Rs. 100.

7. Q. Are they rock-cut wells?—Yes.

8. Q. What is the average cost of a *pakka* well?—Rs. 500.

9. Q. How do you go through rock?—By blasting where the rock is hard. In other cases by means of pickaxes, crowbars, *suktis* or *jhumras*.

10. Q. Are they making new wells?—Yes, the State and people are making them.

11. Q. How much does the State pay altogether in one year?—The allotment is Rs. 30,000.

12. Q. What does that include?—The repair of tanks, *bunds* across nullahs, and *adis* and wells, *pakka* and *kacheha*.

13. Q. Have you many tanks?—Yes, but they are not in very good order; most of them leak.

14. Q. During the famine time were the tanks empty?—Irrigation tanks were, with one exception, all exhausted.

15. Q. You say wells cannot be relied upon. Have you done anything for them?—We have done something.

16. Q. You say Rs. 34,000 was advanced for the construction of wells during the last ten years; of this Rs. 17,000 was advanced in 1899-1900?—Yes, half the total amount was advanced during the famine year. In the early stages of the famine we advanced money for wells. When distress increased, we started relief works.

17. Q. In how many years was the money advanced for wells to be repaid?—No particular period has yet been fixed. It is proposed to fix five years for advances made for *kachcha* wells and ten years for *pakka* wells.

18. Q. Is the State going on advancing money?—Yes.

19. Q. What have you done since the famine year?—I think about Rs. 8,000 was advanced last year, and about Rs. 4,000 the year before that.

20. Q. Are there any good places in your country for tanks?—It is undulating country; where the soil is deep it is suitable for tanks, but not where it is not deep. In the Pachore Pargana almost every village has a tank.

21. Q. Do the people in villages take care of their tanks?—No, they have not the means.

22. Q. But it is only earthwork?—They find wells more profitable.

23. Q. (*Sir Thomas Higham.*)—Are you proposing any new work in the State?—We don't propose new works unless the existing ones have been completed, because we are not quite sure whether the works begun in the famine will prove remunerative or protective. The works should be examined by an expert before any more money is spent on them, as it may otherwise be wasted as I have stated in my note.

24. Q. Are any of the works you began completed?—Two are in working order.

25. Q. How many works are there?—Twenty.

26. Q. What works are they?—Tanks, the deepening and widening of nullahs to be formed into reservoirs by masonry *bunds*.

27. Q. Are you going to complete them?—Yes.

28. Q. And if they answer alright you will make more?—Yes.

29. Q. When you lend money for wells, in how many years do you recover it?—Three or four years, but no particular period is fixed.

30. Q. Do you make advances when there is not a famine year?—Yes, Rs. 8,000 has been advanced in the current year.

31. Q. What interest do you charge?—Six per cent. per annum.

Lala Raushan Lal.

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32. Q. (*Mr. Muir-Mackenzie.*)—Does the State not make wells?—Yes, it is making *pakka* wells.

33. Q. How do they get recouped for their expenditure?—By enhanced irrigation rates. Those who sink wells at their own expense get remission of irrigation rates for a stated number of years under standing rules, which are briefly to the effect that full irrigation rates are not levied on lands irrigated from a new *kacheha* well for five years and from a new *pakka* well for ten years. For lands irrigated from a well made by the State, full irrigation rates are levied from the first year.

34. Q. What are the wells like; are they made in rock?—Yes, as a rule.

35. Q. Is there trap rock?—There is, 15 or 20 feet below.

36. Q. Do you pierce the rock and get to the water below it?—Yes, except in rare cases where the rock is very hard and the piercing too expensive.

WITNESS NOS. 72 AND 73.—SYED SHABIR HUSAIN, Nazim, and SYED QUDRAT ALI, Naib Wazir, Mal, Bhopal.

(*To the President.*)—Bhopal suffered much in famine and we have done a good deal since to improve irrigation.

We don't irrigate from the Betwa river, because it is too deep to permit of irrigation. The biggest tank in the State irrigates 1,000 *bighas* (1 *bigha* = 30,625 square feet). We spent Rs. 50,256-10-0 in repairing tanks in famine. We make field embankments, but not generally. They are not so common as in the adjoining Central Provinces districts. There is a great deal of *kans*. If you leave a field alone for five or six years, the *kans* will disappear. There are many wells, but they are mostly *kachcha*. Wells are the best thing for irrigation. The State is now making them. Our rates are—dry Rs. 2 and wet Rs. 5 or 6 per *bigha*. One well irrigates 3 to 8 *bighas*. A *pakka* well costs about Rs. 500. Black soil is irrigated for opium and sugar-cane only. The people dig *ghattas* for rice 1 foot deep or so both in black and yellow soils.

Syed Shabir Husain and Syed Qudrat Ali.

12 Dec. 02.

Supplementary Memoranda, etc.

NATIVE STATES UNDER BOMBAY GOVERNMENT.

(1) Mr. Vithal Tikaji, Administrator, Akalkot State.

Answers to printed questions.

I.

A.—General.

1. The following answers refer to the Akalkot State. The undersigned has been at the head of all the Departments of the State for 17 years.

2. The average rainfall in each month of the year is as follows:—

Month.	Inches.	Cents.
January	0	13
February	0	15
March	0	44
April	0	48
May	1	19
June	3	88
July	3	91
August	4	82
September	8	74
October	2	97
November	1	26
December	0	7

3. The irrigation work cannot be undertaken by the State for lack of capital for the initial expenditure.

4. The land, which is irrigated from wells constructed by private capital, is exempted from enhancement of assessment on account of irrigation till next settlement.

5. The loans under the Land Improvement Loans Act are not so freely taken by the ryots as they ought to for the extension of irrigation owing to the period of repayment of loans being not sufficiently long to enable them to repay the loans at their convenience and to the delay caused in getting loans soon under the existing arrangement. It is recommended that a special officer be deputed to grant loans on the spot and the maximum period of repayment of loan be extended. The measures recommended for the encouragement of these loans are as under:—

(4) total remission may be granted in case of failure of the attempt to obtain water; and

(5) the maximum period of repayment should be extended to 20 years.

6. The extension of irrigation does not tend to injure the remaining cultivation by attracting its cultivators to the irrigated tracts. There is a strong desire evinced among the people of Akalkot State to have means of irrigation extended to it.

E.—Wells.

34. In the Akalkot State—

(1) the average depth of permanent wells is 12 yards;

(2) the supply of water is met in some cases by springs and in some cases by percolation; it does not become too saline to use, but is liable to fail only in a year of drought;

(3) the average cost of construction of an ordinary well, *i.e.*, with the masonry work for *mot* only is Rs. 300 to Rs. 400, and that of a good well with masonry all round is Rs. 600 to Rs. 1,000;

(4) the average duration of an ordinary well is 50 years and that of a good well is 100 years;

(5) the water is usually raised from a well by *mot*;

(6) the average area attached to and commanded by a well is 3 to 5 acres;

(7) the average area irrigated in any one year is 3 acres.

35. The irrigation increases the value of the produce of land as under:—

(1) three times by rendering it possible to cultivate two harvests instead of one;

(2) six times by leading to the substitution of more for less valuable crops or varieties;

(3) by increasing the yield—

(*a*) three times in a year of ample rainfall;

(*b*) two times in a year of scanty rainfall;

(*c*) one-fourth in a year of drought.

Mr. Vithal Tikaji.

36. The approximate estimate of the increase in the total annual value of the produce per acre due to the irrigation is as follows:—

(1) Rs. 20 on the average of a normal term of years;

(2) Rs. 5 in a year of drought.

37. The average annual rate per acre paid on account of the irrigation is Rs. 3 to 4 to the State in the shape of enhancement of revenue. These rates are paid on the total area attached to and commanded by the well.

38. No serious difficulties are encountered either in the selection of a spot in which a supply of water is obtained or in the actual construction of the well. No assistance is ever offered by the State or by local bodies in the shape of expert advice, trial borings, the use of boring tools, etc. People select the spot with the help of water-finders. Those who are in need of money require help of the State for the construction of wells.

39. The undersigned is of opinion that the State should not undertake the construction of wells in land which is private property. The work done by the owner of the land is less costly than by the State agency.

40. Temporary wells are not commonly used in the State.

II.

Point 2.—The gross area of the State is acres 313,680-5, of which culturable area is acres 274,711-27. The proportion of the latter which is protected by wells is acres 2·92. The soil is very diversified; the north-east portion of the State and the two detached Mahals being hilly and stony consist principally of red and shallow soil, while towards the south and south-west there is a good deal of black soil and garden land. The average rainfall in the State is 32 inches. During the south-west monsoon there is ordinarily a demand for water. The details of the crops which require irrigation are as under:—

Crops which require irrigation.	How many waterings.	For what period.
1. Sugarcane	Once in 4 days	12 months from April.
2. Plantain	Once in a week during first 6 months and after that twice in a week.	15 months from May.
3. Turmeric	Once in a week	8 months from June.
4. Chillies	Do.	4 do.
5. Best rice	Once in a fortnight.	6 do.
6. Tobacco	Once in a fortnight.	4 months from August.
7. Wheat	Once in a week	4 months from October.
8. Sweet potatoes	Do.	6 months from June.
9. *Makka* (Maize)	Do.	3 do.
10 *Hundi*	Do.	3 do.

Mr. Vithal Tikaji.

The irrigation revenue is realized along with the land revenue by two instalments in a year.

Points 3 to 6.—There is no black cotton soil in the State nor any State provincial irrigation, district or village irrigation in the State, and hence no particulars under this head can be supplied

Point 7—The total area irrigated by wells in ordinary years is acres 8,049-22 and in years of drought half of that area. Number of new wells constructed annually during the last 10 years is as under:—

	No.
1891-92	6
1892-93	8
1893-94	9
1894-95	7
1895-96	5
1896-97	18
1897-98	50
1898-99	10
1899-1900	219
1900-1901	30

Most of these wells were constructed by the help of advances from the State. Concessions in the shape of reduced rate of interest and the extension of repayment of loans were granted. It is desirable to stimulate the construction of new wells by more liberal advances or inducements. Almost all the wells in the State were affected by the droughts of 1899—1901. About 25 per cent., i.e, 450 of these wells, ran dry, and most of them were deepened; but in cases of half of that number water was found; and in the remaining cases it failed The average depth of water below surface is 8 yards; while the cost of an ordinary well is Rs. 300 to Rs. 400 and that of a good *pucca*-built well is Rs. 600 to Rs. 1,000. The area served by each well is 3 to 5 acres.

Point 9.—The classification of the works on which relief labour was employed in the State affected and the amount expended on each class are as under:—

Works.	Amount spent in 1899-1900	Amount spent in 1900-1901	Amount spent in 1st April 1901 to 10th November 1901.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Wells	7,105 13 6	15,203 14 6	7,203 6 3
2. Tanks	6,852 8 4	26,580 4 10	...
3 Bandharas in Sheri lands	757 2 1	4,139 6 7	936 9 3
4 Roads including metal-breaking	20,401 2 0	50,337 12 6	3,556 1 9
5. Miscellaneous including cutting prickly pear.	3,487 11 11	11,518 4 4	...
TOTAL	38,604 5 10	1,08,183 11 9	11,740 1 7

Works were completed at the end of the famine. The tanks newly sunk and deepened are found to hold water sufficient for the supply of the villagers and for watering their cattle. In some instances these tank works kept the village well-water supply running as long as the tanks held water.

Point 10.—Special programmes were made and kept in readiness with the sanction of the Political Agent. The works were thrown open to the people as the necessity arose.

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(2) MR. R. G. O'SHAUGHNESSY, A.M.I.C.E., Executive Engineer, Radhanpur State.

Answers to printed questions.

I.

Mr. R. G. O'Shaughnessy.

2. The gross and culturable area of land in the Radhanpur State is 3,32,357 acres and 27 gunthas, none of which is protected by State Irrigation works or by private or village works, but irrigation under wells excavated by the cultivators themselves is done in some villages and to a large extent in villages situated close to the Banas river. The character of the soil in the State varies, some portion of it is black, growing cotton, wheat, gram and barley; a second kind, a lightish soil mixed with sand called Goradu, growing different kinds of pulse, such as Tuvar, Mag, Adada, Millet, Juwari, Kuri, Banti, Chola, Guvar, Rapeseed, Dhana and Jiru; a third kind, a sandy soil, locally known as Timba grows three different varieties of plants from which oil is extracted, and called Sesamum, Castor and Sarsao. No portion of the cultivation in this State is dependent on artificial irrigation. The average rainfall of the State is 15 to 20 inches, but the State has not had such a fall since the year 1896, the rainfall since then amounting to 18·62 inches in 1897, 8·57 inches in 1898, 1·8 inches in 1899, 17·47 inches in 1900 and 0·83 in 1901. There is no demand for water in Radhanpur State during the south-west monsoon, if the monsoon is an average one. The crops requiring irrigation are wheat, barley and chasto (a grain resembling juwari); vajia or soft wheat requires 8 to 10 waterings from the month of November to the beginning of February following. Barley 7 to 8 waterings during the same period as stated above for wheat. Chasto requires more watering as it is grown in the beginning of the hot weather, and needs to be watered once in every four days from the month of March to the end of May. There is no distribution to control and no revenue realized from irrigation.

3. Black cotton soil produces two different varieties of wheat *vajia* or soft wheat requiring watering and *chasva* or hard wheat needing no watering and is dependent solely on rain. No tanks have been constructed in this soil for holding water, but high earthen dams could be made of it without masonry core walls. There is no demand for water in black soil when there is an average rainfall, but it is needed in case of prolonged drought. No irrigation has been attempted in such soil in this State, but there is a falling off in years of scanty rainfall and prolonged drought; making the revenue more precarious on this account owing to it being impossible to water the land by well irrigation, the saltish nature of the water found in wells excavated interfering with the growth of anything planted in the land. There are no storage tanks in the State commanding other classes of soil The owners of black soil in this State have not expressed any desire for irrigation works, and the construction of tanks in such soil is not considered remunerative or as important as for other classes of soil.

4. There are no State irrigation works in existence. The only possible source from which irrigation could be carried on is the diverting of the flood waters on the Banas river and this is now under investigation.

5. No irrigation works, hence this query cannot be replied to.

6. Query 6 is left unanswered for reasons similar to those quoted above.

7. In ordinary years the area irrigated by wells amounts at the most to about one thousand acres, and in years of drought to about 3 to 5 thousand acres. Very few new wells have been excavated during the last ten years. No assistance was rendered to the cultivators during previous famines but the possibility and desirability of constructing wells is now being made plain to the cultivators, and I consider wells being excavated in the bed of the Banas river a few feet away from the *tol* of the right bank in the initiative and under the orders of Major O'Donnell, I.S.C, Administrator of Radhanpur, will very greatly mitigate distress till next rains. The few wells excavated in a corner of the State to the south-east did suffer in so far that the level of the water was reduced by 2 to 3 feet, and the water also turned brackish. None of the wells ran dry to necessitate deepening. About 100 wells where the water turned brackish were abondoned. In portions of the State the water is 10 to 15 feet below the surface, and in others 15 to 30 feet; the cost of these wells averages from 10 to 15 rupees in the case of a well without brick steining and Rs. 200 to Rs 400 in wells with brick steining. Six to ten acres is the area of land served by each well.

The reports of Mr. Crimp and the geological officers on the possibility of artesian wells in Gujarat have not been sent to this State.

9. The following works were started in this State on which relief labour was employed :—

		Rs.	a.	p.
1.	Radhanpur-Dhadhana Road	30,094	8	0
2.	Radhanpur Big Tank	15,643	12	0
3.	Radhanpur Deodar Railway Bank	22,319	4	0
4.	Canal near Desai Gate	6,467	0	0
5.	Oorumana Drainage and Radhanpur Sami Road.	1,42,714	12	0
6.	Deepening of Tanks in different villages.	10,419	4	0
	TOTAL	2,27,688	0	0

II.

A.—GENERAL.

1. To the Radhanpur State.

2. A statement showing the rainfall for each month for the years 1896, 1897, 1898, 1899, 1900, and 1901 is given below :—

Month.	Year 1896.	Year 1897.	Year 1898.	Year 1899	Year 1900.	Year 1901.
January	...	0·05	...	...	...	...
February	...	...	0·15	...	...	...
March	...	...	...	...	...	...
April	...	0 03	...	...	0·50	...
May	...	...	0 03	0·76	0 03	0 09
June	4·32	0 10	0·17	0·03	...	0 37
July	10·54	5·35	6·89	...	1·25	3·27
August	9·20	7 93	0·17	...	12·52	2·68
September	0 01	4·81	0·26	...	3·14	0·37
October	...	0·35	...	0·09	...	0·06
November	0·92	...	...	...	...	...
December	...	...	0·15	0·20	...	...
Total for each year	25·10	18 63	5·57	1·08	17 47	0·83

(1) There is no sparsity of population if a system of flow irrigation could be introduced.

(2) There is a sufficient supply of cattle suited to the cultivation of irrigated land.

(3) The supply of manure is sufficient.

(4) The soil is quite suited to irrigation

(5) The only uncertainty as regards the supply of water with reference to its too late commencement or too early cessation lies in the failure of rain, all cultivation in the State at present being dependent on the rainfall.

(6) There is a lack of capital on the part of cultivators for the initial expenditure of expensive cultivation of irrigated crops.

(7) There is no fear of enhanced rent or revenue assessment.

(8) Tenures certain during good behaviour.

(9) None.

4. No land is irrigated by works constructed by private capital.

5. The Land Improvement Act is not in force in the State.

6. The people desire flow irrigation.

B.—CANALS OF CONTINUOUS FLOW.

There being no canals of continuous flow these questions are left unanswered.

C.—CANALS OF INTERMITTENT FLOW.

There are no canals of intermittent flow in the State. A canal 8 miles in length was excavated about ten years ago from the Banas river, a mile and-a-half to the east of Badarpura for carrying flood water to the tank at Radhanpur on which the population depends for its water supply. No masonry work was built across the river to divert the floods, and on only one occasion was the desired object fulfilled, and this, I am told, cost Rs. 4,000 and was spent in throwing up a temporary dam of sand bags. The canal is badly graded, badly sectioned, and unprovided with any works to carry off crop drainage, with the result that cross drainage that has entered it has scoured the canal in several places, rotted it up in others, and the side slopes of the canal have suffered a good deal from erosion.

Mr. R. G. O'Shaughnessy.

D.—TANKS.

23.

(1) The tanks in the State are entirely dependent for their supply on rainfall.

(2) The water in these tanks is not used for irrigation, but is collected to supply drinking water to the villagers and their cattle.

(3)

(*a*) in a year of ample rainfall for twelve months ;

(*b*) from three to five months in a year of scanty rainfall ;

(*c*) they dry up entirely in a year of drought.

24.

(1), (2), (3) } There is no irrigation under these.

(*a*), (*b*), (*c*) } Tanks.

25.

(1), (2) } Ditto.

26.

27.

(1)

(2)

28.

(1)

(2)

(3)

E.—WELLS.

34.

(1) 15 to 30 feet in some parts and 10 to 15 in others.

(2) Some of the wells are supplied from springs and others from percolation ; they do not fail, but the water turns brackish—

(*a*) not in an ordinary year,

(*b*) but in a year of drought.

(3) Temporary wells cost Rs. 10 to 15 and permanent well Rs. 200 to 400.

(4) A well without brick steining lasts five years and one with brick steining lasts permanently.

(5) by means of the kos ;

(6) six to 10 acres,

(7) about 8 acres.

35. Well irrigation is only practised by the cultivator in this State when the rain fall is deficient.

36. None.

37. Rs. 2.

38.

(1) There are serious difficulties in the selection of a spot in which a supply of water will be obtained.

(2) There are no difficulties in the actual construction of wells.

39. Yes. By giving *takavi* advances to cultivators who may wish to dig wells for irrigating purposes.

40. Yes. They have some protection against drought, but it is hoped that the experiments being made this year and replied to under querry 7 forwarded with No. 2275 dated Bombay Castle, 26th October 1901, will show that they can be to an appreciable extent a protection against drought.

MYSORE.

Mr. H. V. Nanjundayya.

(3) *Letter No. 2865-Rev., dated 2nd January 1902, from H. V. Nanjundayya, Esq.*, M.A., M.L., *Secretary to the Government of Mysore, Revenue and General Departments, to C. L. S. Russell, Esq., I.C.S., First Assistant to the Hon'ble the Resident in Mysore.*

In reply to your letter No. 6316, dated the 18th December 1901, concerning information to be furnished to the Irrigation Commission of the Government of India, I am directed to state that although it was not possible to get replies from all the Deputy Commissioners within the short time at the disposal of the Darbar, the accompanying note has been drawn up, furnishing as complete information as it has been possible to collect on the several points mentioned in the Memorandum received with your letter under reply. A printed note prepared by the Chief Engineer is also forwarded herewith.

2. Copies of the answers given by some of the experienced Revenue and P. W. D. Officers, to the set of questions which accompanied your letter, are also forwarded herewith.

3. The principal Revenue and P. W. D. Officers under the Darbar, and a few of the experienced retired officers and non-official gentlemen, named in the appended list,* have been selected as witnesses to give oral evidence before the Commission during their sittings at Bangalore. In the event of any of these officers and gentlemen being required to appear before the Commission, I am to request that early intimation may be kindly given to the Darbar so as to enable them to communicate with the persons concerned in time.

Note furnishing information on the points to be considered by the Irrigation Commission in Mysore.

1. POPULATION, AREA, ETC.

The population according to the Census of 1901 of each of the eight districts into which the Mysore State is divided, is as shown below:—

(1) Bangalore district	. . .	788,368
(2) Kolar do.	. . .	722,751
(3) Tumkur do.	. . .	678,883
(4) Mysore do.	. . .	1,293,666
(5) Hassan do.	. . .	568,508
(6) Shimoga do.	. . .	532,135
(7) Kadur do.	. . .	362,134
(8) Chitaldrug do.	. . .	497,048
	TOTAL .	5,443,923

The gross cultivable area is—

Acres.		
843,914	in the Bangalore district.	
795,661	do. Kolar	do.
1,469,781	do. Tumkur	do.
1,561,762	do. Mysore	do.
915,950	do. Hassan	do.
878,510	do. Shimoga	do.
621,230	do. Kadur	do.
1,568,883	do. Chitaldrug	do.

The average cropped area in each district is given below:—

	Acres.
Bangalore district	629,502
Kolar do.	477,094
Tumkur do.	834,125
Mysore do.	1,122,047
Hassan do.	634,899
Shimoga do.	597,264
Kadur do.	443,496
Chitaldrug do.	900,694

The area irrigated in a normal year and that irrigated in a year of drought, are compared below:—

Year.	Area irrigated by State Irrigation Works.	Private Works.	Wells.	Total Area.
1892-93.	Acres.			Acres.
Normal year .	562,997	1,331	63,064	627,392
1891-92.				
Year of drought .	520,045	620	58,313	578,978

* Not printed.

2. SOILS.

The kinds of soils locally recognised as different are given below:—

(i) "Yare:" black cotton, which is quite free from stones.

(ii) "Kari:" black cotton but stony.

(iii) "Kengalu:" red or brown soil, which is mixed with loam and vegetable mould.

(iv) "Maralu:" which is sandy.

(v) "Kallu Murlu:" stony and gravelly soil.

(vi) "Bile Karlu:" white stiff loam.

(vii) "Saulu:" saline earth.

The different soils are distributed over the country as indicated below:—

Bangalore District.—The prevailing soil is poor shallow red, gravelly, red and sandy, and red and dark, varying in proportions. The first and second varieties prevail more or less in all the *taluks* of the district, the first predominating in Magadi, Closepet and Kankanhalli *taluks*, and the last is found in favoured localities, especially on the banks of large streams or beds of tanks where alluvial deposits are continuously made.

Kolar District.—The soil on the high grounds is red and gravelly. The soil in the valleys is a loamy mixture. On the first ascent from the valley it is a mixture of loam, sand, and oxide of iron. Higher up a silicious sand prevails. Below the superficial soil there is commonly a bed of gravel which immediately covers a gneissic or granitic rock very often in a state of disintegration considerably advanced.

Tumkur District.—Red soil is abundant in the southern and western parts of the district. The eastern portion is sandy and the northern portion partly contains black soil. Except in a few places, the soil is generally hard and poor, requiring much labour and manure to render it productive. Lands irrigated by tanks and spring channels in some of the *taluks* in this district are exceptionally remarkable for their fertility.

Mysore District.—Rich and fertile black cotton soil is found in the eastern portion of the Chamrajnagar *taluk*, major portion of the Yelandur Jahgir, southern portion of the Tirumakudlu-Narsipur *taluk*, and a portion of the Gundlupet *taluk*. Rich red soil is found in a limited area of the district. Red soil mixed with more or less sand varying from a loose greyish or reddish to deep red, and gravelly soil, are found in the remaining parts of the district.

Hassan District.—In the Malnad there is a rich sedimentary soil with forest loam in the jungles and a red laterite soil on the grassy hills. There are also extensive tracts of sandy soil and small patches of black soil in the Arkalgud, Channarayapatna and Arsikere *taluks*.

Kadur District.—There is to be found rich tract of black cotton soil along the south of the Babsbudan Mountains and a portion of the Tarikere *taluk*. The soil is red sedimentary in the Malnad. The western portion of the Tarikere *taluk* is sandy and gravelly.

Shimoga District.—The western portion generally contains a substratum of laterite. In the Malnad villages it is loose and sandy. In the garden lands it is stiff and clayey. Black soil is found to a small extent in the Honnali *taluk*.

Chitaldrug District.—In the *taluks* to the north and west of Chitaldrug the black cotton soil prevails interspersed with sandy and gravelly tracts. In the west a red and loamy soil is found. In the south the soil contains much saline matter. The eastern *taluks* present a light sandy soil abounding in springs.

Black cotton soil does not require much water for irrigation as it retains moisture for a longer time than red, gravelly and other kinds of soil. The black friable kind allows of free subsoil drainage and therefore requires more water than compact varieties of reddish laterite or gravelly earth. These latter are regarded by the *raiyats* as being very good specimens of soil for raising wet crops. In the opinion of the Chief Engineer red soil is generally very fertile and is well adapted to irrigation, and black cotton soil is more suited to dry crops, but can be irrigated with advantage. As far as his knowledge goes, he says that no difference is made in the quantity of water supplied to cultivation on different kinds of soils.

3 Black Cotton Soil.

Tanks constructed in such soil hold water for a longer time than those constructed on other soils, except gravelly soil. The Chief Engineer states that there are many small tank *bunds* in the State constructed of black cotton soil which do not leak; that he himself constructed such a *bund* to hold 30 feet of water with no masonry core-wall but with a puddle-wall in the centre, which stood for twenty years; that black cotton soil dries and cracks badly in the hot weather, and a *bund* made of it is likely to leak and perhaps breach, if it has not been soaked with rains; but that in the case of tanks which cannot fill unless there has been rains, the *bund* is nearly always saturated. He adds that in the case of channels it is different, as when water is let into them when the banks of black cotton soil are dry, the result will be excessive leakage and excessive breaches.

In average years of rainfall there is no demand for water as far as black soil is concerned, while in seasons of drought there would be occasional demand for it for dry crops which are mostly grown on this description of soil. But it must be noted that the system of assessment in the State does not allow of this being properly ascertained. The lands which are capable of irrigation are nearly always assessed as wet lands and are entitled to water for irrigation. The practice of obtaining water at special seasons to water ordinary dry crops does not obtain here. Only in dry seasons some of the enterprising cultivators would save their more valuable crops by well irrigation. Those that, on account of unfavourable seasons, grow dry crops on lands assessed for irrigation, may occasionally use water from tanks, etc. for irrigating such crops when available.

The irrigated area does not fluctuate to any appreciable extent in proportion to rainfall, except so far as it affects the supply of water in tanks. This does not apply to Malnad tracts of course, where paddy is grown by rain-water irrigation. As the assessment on lands is calculated on the average outturn of good and bad years, the revenue does not suffer in years of partial drought, remissions being granted only when there is widespread distress. The black cotton soil lands being valuable, the *raiyats* do not run the risk of relinquishing the same in seasons of drought.

Generally, *raiyats* do not care to have their black cotton soil lands irrigated, and moreover, no good sites in such lands are available for constructing such tanks. The construction of such works is costly and not remunerative, unless provision is to be made for occasional watering when rains fail. In the dry district of Chitaldrug *raiyats* are allowed to construct small reservoirs called *taguvali kattes* on their own lands for retaining surface moisture to help the cultivation of dry crops.

4. State Irrigation Works.

The number and description of the State Irrigation works are—tanks 29,015, and channels 537. The total outlay incurred on them from 1881 to 1900 was Rs. 198,03,000. The total area irrigated by the State Irrigation works in the dry years of 1891-92 and 1896-97 was 520,045 and 559,191 respectively as compared with the figures for the normal years of 1892-93 and 1895-96 which were 562,997 and 587,605 respectively. The total revenue derived under the State Irrigation works for the year 1899-1900 was Rs. 36,58,116. Deducting from this the average annual working expenses amounting to Rs. 1,27,400, the net revenue for that year was Rs. 35,30,716.

Except the Cauvery Channels and tanks fed by perennial streams in the Malnad parts of the State, the other works are not, generally speaking, to be depended on in seasons of drought.

5. Future Extensions.

Detailed information on this head is furnished in the Note by the Chief Engineer.

6. Village or Private Irrigation Works.

The number of private irrigation works excluding wells and the aggregate extent of cultivation dependent on them, are—

Class of tanks	Number of tanks.	Area irrigated. Acres.	Assessment. Rs.
Kodagi or private enterprize tanks.	1,014	23,139	1,18,991
Inam tanks . . .	1,049	23,624	96,903
Total .	2,063	46,763	2,15,894

The private irrigation works aforesaid having been constructed or restored by private individuals, are required to be maintained by them, as in consideration therefor they enjoy some concession in the shape of grant of Inam lands, or of remission of a portion of the assessment of the lands under such tanks. Some of the tanks being situated in Inam or alienated villages, the holders thereof are bound to maintain them.

Generally, no expenditure is incurred by the State on these works, but when they are in a series with Government tanks, or are above a railway line, and the parties concerned fail to do the necessary works and maintain them in proper condition, the Government will, in order to prevent danger to the Government tanks or to the railway line, carry out the required work and recover the cost thereof from the persons concerned as arrears of revenue. The Government derives no increase in revenue, direct or indirect, from these works. There does not appear to be any considerable scope for the construction of new works of this class. Only in a few cases, dilapidated and abandoned tanks not considered fit to be taken up by Government, may be restored by private persons, at their own cost, on the condition of Government granting to them one-fourth of the assessment paid on the lands under such tanks under the existing rules.

7. Rice and sugarcane are usually irrigated by canals and tanks. Sugarcane, jola, ragi, and more rarely rice, and potatoes, and other garden crops, are grown under wells. In river canals, water is usually let from the 1st June to the end of December of every year, which is the cultivation season. For rice cultivation, the irrigation is practically continuous during the season. For sugarcane crops, water is given occasionally in summer also. The distribution of water from canals and tanks is controlled by the Revenue Department during the cultivation season, channel managers and *sowdies* attending to this work in the case of river canals, and *nirgantis* and *patels* in the case of tanks. The area under irrigation is divided into a convenient number of blocks with reference to their situation as regards the cross-valleys and ridges, and sluices are provided to discharge the quantity of water required for irrigating each block, cultivators being left to regulate the supply required for their lands.

8. Statistics for Typical Works.

Will be found in the accompanying Note by the Chief Engineer.

9. Flood Protection and Drainage Works.

No flood protective or drainage works are required in the Mysore State.

10. Relief Works.

During the famine of 1876-77 relief labour was employed in collecting metal for and in making roads, opening out railway line from Bangalore to Mysore, and constructing new and improving old tanks, and on other works of sanitary improvement.

Mr. V. Aiyasawmy Iyer.

(4) *Statement showing the Initial Statistics for some of the larger or Typical Storage Works in the Kadur Division.*

No.	Particulars.	Kuksandra tank.	Ayyenkere tank.
1	Area and nature of catchment	147 square miles exclusive of tanks above, and 217 square miles inclusive of tanks above.	43·35 square miles.
2	Assumed average annual rainfall	24 inches	50 inches.
3	Full supply capacity of tank in m. c. feet	At R. L. 50·00 723 units At R. L. 53·00. 1,214 units	1,532 units or 400·4 units.
4	Percentage of capacity on assumed average rainfall.	4 per cent.	8 per cent.
5	Water-spread at full supply	At 50·00. 592½ acres At 53·00 799 acres At 55·00. 957 acres	460 acres.
6	Maximum height and total length of dam (bund and weir).	35 feet . 3,700 feet	40 feet . 600 feet.
7	Cost of dam, waste weir, sluices	Rs. 1,06,125 (dam) Rs. 8,918 (waste weir) Rs. 6,743 (sluices)	Rs. 5,200 (waste weir). Rs. 750 (sluices).
8	Compensation for land submerged by tank	Rs. 1,515	*Nil.*
9	Cost of canal and distributing channels.	Rs. 28,680	Rs. 32,500.
10	Total capital cost	Rs. 1,55,535	Rs. 38,516.

(5) Mr. K. Shamiengar, Khedda Superintendent (Retired).

Answers to printed questions.

Mr. K. Shamiengar.

A.—General.

1. The answers refer to the Mysore province I was a Revenue Officer for a long time and held estates in the Province.

2. In my Sulikere Estate from January 1896 to 1901 the average rainfall in each month is the following:—

Months.	In.	Cts.
January	...	...
February	...	...
March	...	...
April	...	...
May	0	55
June	1	66
July	2	21
August	2	48
September	2	48
October	4	...
November	2	56
December	1	24

3. (1) Although many big irrigation works have been constructed in the province, yet wet cultivation has not been sufficiently carried out for want of population.

(2) There is sufficient supply of cattle.

(3) There is sufficient supply of manure.

(4) Wet cultivation is carried on on a black cotton soil in the Mysore province.

(5) In bad years there will be less supply, and its too late commencement or its too early cessation is probable.

(6) Yes.

(7) & (8) Yes.

(9) The resettlement of survey rates after thirty years' guarantee is the great impediment for the extension of wet cultivation.

4. In Mysore province the remission of one-fourth assessment on lands irrigated from works constructed by private capital is permanent. No exemption is extended to tenants by landlords. The existing provision in this respect requires, as from experience, modification. The remission of one-fourth assessment does not give sufficient remuneration to the owners of the tank.

5. (1) Loans under Land Improvement Act are not freely taken, as most of the population are ignorant of the existence of such Act. The Act requires modification, as the loan is only confined to the *raiyats* who already hold lands. This has interfered with foreign cultivators.

(2) Remission of interest is very necessary as irrigation brings on enchanced revenue to Government and eventually proves greatly beneficial to the country to meet the requirements in case of famine, etc.

(3) & (4) Partial or total remission of advance varying according to the circumstances is necessary in case of failure of the attempt to obtain water.

(5) & (6) The extension of the period of repayment and grants-in-aid are required.

6. No. In Mysore province *raiyats* attend to both dry and wet cultivations, as dry cultivation is carried on to such an extent as to make provision for their food and maintenance of cattle, expecting large profit from paddy, sugarcane, and garden cultivation under irrigation. There is strong desire evinced among the people of Mysore to have the means of irrigation extended or increased.

B.—Canals of continuous flow.

7. The irrigation increases the value of the produce of land by 20 times greater by allowing to raise superior crops, such as paddy, sugarcane, garden, etc. Also by rendering it possible to cultivate two harvests

8. (1) The value increases 20 times.
(2) Do do 30 times.

9. There is no private channel in the province. The average annual assessment paid to Government is Rs. 5 per acre. The assessment is paid on the whole irrigable area.

10. The private expenditure is incurred on the excavation of subsidiary channels from main channel, sometimes by landlord and sometimes by tenants. The tenant recovers the cost from the landlord by withholding from the share of produce due to him at the time of harvest.

11. From too profuse, too extensive, or too frequent irrigation, from water-logging, and without manure, the locality becomes malarious and the soil becomes saltish, prohibiting the growth of crops. From experience both these damages have been gradually removed by high manuring and drainage.

C.—Canals of intermittent flow.

12. It is very rare in Mysore province to throw temporary dam across river-bed, but channels are excavated in river-beds wherever they find spring water, and then irrigate lands if level permits. This plan is adopted after the monsoon. Spring channels are adopted in tank-beds leading the water to the sluice as a temporary measure.

These springs can be secured only in a year of ample rainfall, but it is denied in years of scanty rainfall and drought. The uncertainty of irrigation under this head does not give opportunity to raise the crop, as only one harvest is realized after monsoon. This kind of irrigation increases the value of the produce from 5 to 10 times only in the year of ample rainfall.

13, 14, 15 and 16. In some parts of Mysore province the irrigation from river, tank-bed channels, is supplemented by irrigation from wells only in case when sufficient supply is diminished in the spring.

17. Although temporary river-bed channels are excavated by people having joint interest, yet they irrigate their lands according to their local arrangement by paying to Government between 3 to 2 rupees per acre on the whole irrigable area.

18. The river-bed channels and the subsidiary ones are excavated by cultivators themselves. If the sub-tenant contributes his labour, he recovers the cost from the landlord from the share of produce during harvest.

19. No.

20. This work being excavated by cultivators themselves during few months of the year according to circumstances of the locality under joint interest, no expense is incurred in any shape more than the contribution of manual labor, nor any legislation is required.

21. None.

22. Not required.

D.—TANKS.

23. Tanks are supplied with water by surface drainage area as well as by means of river channels and by diversion of jungle streams.

(3) In the year of ample rainfall the water is distributed for two crops during nine months of the year.

24. The same value mentioned under temporary channels can be applied to the lands under tanks.

25. If sufficient rainfall is denied, and thereby the tank receives scanty supply, the harvest will suffer, and thereby diminish the value.

26. In some localities the irrigation is ordinarily supplemented by wells whenever the supply of water is diminished in tanks

27 From 5 to 10 times.

28. The lands under tanks are rather heavily assessed, ranging from Rs. 7 to 4 per acre This is a general complaint Under private tanks the owners receive their shares in kind, but no ready-money payments are made. Great hardship is caused by recovering assessment on the whole irrigable lands and also during the years in which the tanks do not receive supply of water or receive only scanty supply insufficient to raise crops.

29. The same answer as under the subjects A, B, and C.

30. In Mysore province most of the tanks are Government reservoirs. The rule that small tanks should be maintained by villagers has seriously helped the deterioration of the tank, as neither Government maintain them, nor *raiyats* contribute free labour as expected by Government. *Mr. K. Shamiengar.*

31. None.

32. It is necessary to encourage and assist the construction of further tanks by private persons by granting remission of half of the assessment.

33. Yes. Much inconvenience is experienced in this province. This question is much neglected. Every year the tank receives silt varying from 3 to 2 inches deep. By under-survey system granting all assessed lands adjoining to the bed for cultivation without taking into consideration that such grant would help the collection of silt in the tank and gradually diminish the supply of water. This point was being considered previous to the Survey system. After the Survey Settlement all lands adjoining to Sulekere tank bed were granted for cultivation, and this helped the collection of silt to nearly 10 feet. No attempt has yet been made to prevent the collection of silt by planting trees on the margin of beds.

E.—WELLS.

34 In Mysore province well irrigation is adopted in all Maidan districts. The average depth of wells is 40 feet. The supply will be both from percolation and spring The average cost of construction depends on the circumstances of the locality. The water is raised by means of bailing, pikota and mot. A well irrigates from 3 to 2 acres.

35. The value will be increased from 3 to 5 times.

37. The revenue paid for irrigable lands under well system varies from Rs. 3 to 2 per acre.

38. Yes. No assistance is offered by Government or by local body.

39. No.

40 Yes. Sometimes wherever spring offers, encouragement can be offered by granting temporary advances at the time of drought.

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(6) MR. T. ANANDA ROW, Director of Statistics in Mysore.

Answers to printed questions.

NOTE.

Para. 1 of Memo.

POPULATION, AREA, ETC.

1 *Area available for cultivation per head of population.*—The Province of Mysore is, for administrative purposes, divided into eight districts covering an area of 29,431 square miles according to the most recent computation, and containing a population of 5,448,923 souls according to the most recent census of 1901. (The Civil and Military Station of Bangalore is not included in these figures.) Upon meteorological, orographic and agricultural considerations, the Province has to be regarded in two parts, *viz*, the Western Division comprising the Malnad (mountain country) and semi-Malnad tracts constituting the Hassan, Kadur and Shimoga districts, and the Eastern Division comprising the comparatively open country constituting the other five districts of Bangalore, Kolar, Tumkur, Chitaldrug, and Mysore. The area and population of these divisions are as follow:— *Mr. T. Ananda Row.*

Population in 1891.	Population per square mile in 1891.	Division.	Area, square miles.	Population in 1901.	Population per square mile in 1901.
1,372,996	145	Western Division . . .	9,483	1,463,077	154
3,470,527	174	Eastern Division . . .	19,948	3,985,846	200
4,843,523	164	TOTAL .	29,431	5,448,923	185

Of this area, 2,166 square miles comprise alienated tracts for which statistics of cultivation and crops are not available. The population of these tracts reckoned at the same proportion as at the census of 1891 may be taken to be 487,475.

The remainder, *viz.*, 27.265* square miles, stand distributed as follows:—

	Acres.	Sq. miles.
Forests	1,361,746	2,128
Not available for cultivation .	7,429,445	11,608
Remainder culturable area available for cultivation . .	8,658,694	13,529
	17,449,885	27,265

with a population of 4,961,448.

Thus, the area available for cultivation comes to be about 1·75 acres per head of population on an average.

It is much the same in both divisions, the exact proportions being 1·74 for the Western Division and 1·75 for the Eastern Division.

2. *Occupied and cropped areas.*—As regards cropped areas. The Cadastral survey of the province being completed, we know accurately the area of land occupied and paid for. But how much of this is in any year left fallow or kept for pasture, and how much under crops, is matter for surmise. The surmise may not be as reliable perhaps as in the Madras Presidency where the progress of cultivation is subject for monthly inspection and report. But the surmise for the province being a summary of surmises for the village made annually by the *shanbhog* (village accountant) field by field, it may be regarded as reliable as

* 29,431—2,166=27,265.

Mr. T. Ananda Row.

such surmises can be. The occupied and cropped areas have been as shown below for the last two years 1899-1901 :—

Year.	Occupied area.	Cropped area.	Percentage.
	Acres.	Acres.	
1899-1900 . . .	6,972,071	5,714,099	82
1900-1901 . . .	7,059,789	5,893,622	83

Taking the past ten years 1891-1901 the averages for this period have been as shown below :—

Division.	Occupied area.	Cropped area.	Proportion.
	Average of ten years 1891-1901.		
	Acres.	Acres.	Per cent.
Western Division .	1,940,181	1,662,653	86
Eastern Division .	4,831,224	4,068,232	84
Total Province .	6,773,403	5,730,885	85

The occupied area has been steadily increasing year after year (except in 1897-98 when there was a small decrease); so that in the last eight years out of the ten the area in actual occupation has exceeded the average above shown; and in seven out of the ten years the cropped area has exceeded the average thereof above shown.

For the purpose of calculating the ratio between population and occupied or cropped areas, be it noted that the population of the tracts to which the foregoing statistics relate is 4,410,209 by the census of 1891 : 4,961,418 by the census of 1901.

3. *Irrigated area.*—The areas irrigated during the ten years 1891-1901 under all sources of irrigation show an average of 891,692 acres per annum, the said average being exceeded in seven years out of the 10, and being distributed for the Eastern and Western Divisions as follows :—

Division.	Average area irrigated. Acres.
Western Division . . .	467,827
Eastern ,, . . .	423,865
TOTAL .	891,692

Taking the sources of irrigation separately, the average areas stand as follows :—

	Acres.
By Government river channels . . .	96,905
By private do . . .	2,110
By Tanks	487,734
By Wells (mostly private wells) . . .	67,113
	653,862
From other sources	242,242
	*896,104

* The difference between this figure and 891,692 shown under all sources of irrigation is due to absence of figures for some years for private channels and wells.

4. *Normal year and year of drought.*—What is a normal year and which comparatively a year of drought for the province as a whole, it is difficult to say. A study of the figures given in Table IV of the Rainfall Report for 1900 will show how much the conditions vary in the different parts. The average for each district and for the whole province is not given there; but taking the head-quarters of districts only, it will be seen that of the past 12 years ending with 1900, the year 1891 was the year of least rain in Bangalore, Kolar and Tumkur; 1899 was the year of least rain in the other five places including Chitaldrug where it was even less in 1900.

Para. 2 of Memo.

SOILS.

5. *Soils: their description and distribution.*—The Mysore *raiyat* is able to discriminate minutely and to judge what soil best suits what crop. But it does not appear that the soils and sub-soils and produce of Mysore have been the subject of close scientific study by chemical analyses, etc. It is a virgin field therefore which lies before the Agricultural Chemist recently appointed. Such as it is, the subject of soils will receive the best elucidation from the Survey and Settlement Department; while for purposes of contrasting the soils of Mysore with those commonly met with in Hindustan, probably no better account can be found than that given at pages 4 and 5 of Mr. Elliot's Report on Mysore Famine of 1876-78. There is a good summary given at page 10 of the Mysore Atlas, 1900, where the names and descriptive particulars of the eight different kinds of soil recognised by the cultivators are also given. Of them I have found that No. 2, "*Kara*, black cotton ground, stony," and "No. 5 *Kallu Maralu*, stony and gravelly," *are least affected by deficiency in rainfall. The following* notes taken from settlement reports, most of which appear also in Mr. Rice's "Gazetteer of Mysore," may be found to be somewhat in greater detail :—

Bangalore District.—The prevailing soil is a red loam of great fertility found in every variety of color from light to dark red and deep chocolate.

Kolar District.—On the high grounds red and gravelly with very often rocks of schistic or gravel of little cohesion appearing on the surface. In the valleys it is a good loamy mixture formed of the finer particles of the decomposed rocks washed down and deposited during the rains.

Tumkur District.—The southern and western *taluks* are most abundant in the red soil and contain large tanks. The eastern *taluks* abound in sandy soil. The northern *taluks* contain some black soil.

Chitaldrug District.—The black cotton soil prevails throughout the *taluks north* and *west* of Chitaldrug interspersed with sandy and gravelly tracts. In the west a red and loamy soil occupies the valleys. In the south the soil contains much common salt, and on that account is favourable to the growth of cocoanut trees, of which there are large and numerous plantations, which extend southwards into the eastern *taluks* of the Kadur and Hassan districts and the western *taluks* of the Tumkur District. The eastern *taluks* have a light sandy soil abounding in springs more or less perennial which are tapped at short distances and the water is conducted with great ingenuity and labour, by narrow channels, to the fields. or, as is more often the case, a *kapile* (draw) well is constructed in the bed or at the edge of the stream by which the water is raised by two or four and sometimes even six bullocks. The water is generally near the surface, but very often wells require to be cut through a soft porous rock composed of decomposed hornblende, which however forms a wall of tolerable durability. These wells have sometimes been likened to cocoanuts with a hole cut through the shell and kernel to get the water out to drink. This, however, is a characteristic of the eastern half of the district. In the western half the water level is lower, and hard strata of rock have sometimes to be perforated before the springs are reached.

Mysore District.—The red soil is most abundant and prevails throughout the district largely intermixed with gravel. Black soil is found in the south-west part of the district which lies beyond the Gundal, Kapila and Cauvery rivers, that is to say, in parts of the Gundlupet, Nanjangud and T. Narsipur *taluks* and in the Chamrajnagar *taluk* and the Yelandur Jahgir.

Hassan District.—The soil of the Malnad and semi-Malnad is a rich, red sedimentary with forest loam in the jungles and a red laterite soil on the grass-covered hills. The produce of these parts is rice in the valleys and coffee and cardamom in the forest slopes.

The soils in the plains surrounding the hills are generally of a rich sedimentary character, easily worked, and affording finer crops of cereals or garden produce. In the valleys it is more clayey and darker in color and yields some of the richest crops of rice in the country.

The black soil occurs to a very small extent in Arkalgud, Channarayapatna and Arsikere *taluks*.

Kadur District.—In the Maidan parts of the district, along the south of the Bababudan Mountains, there is a tract of rich black cotton soil whose fertility is enhanced by the command of an unfailing supply of water. The higher parts of this region are generally gravelly. Black cotton soil is found also in the eastern part of Tarikere *taluk* in the neighbourhood of Ajjampur together with red and gravelly soils, while in the western parts of Tarikere *taluks* sandy and gravelly soils prevail. About Yegeti, east

of Kadur, the soil is poor and has a white chalky appearance. More to the south it improves till it is adapted to the cultivation of cocoanuts without irrigation as in the adjoining parts of Hassan, Tumkur and Chitaldrug districts.

Shimoga District.—The soil in the rice valleys so characteristic of the Malnad is loose and sandy, while that of the garden lands is stiff and clayey. The richest soil of the district is on the north-east from the Sulikere tank northwards. The black soil prevails here as also around Nagamati and Beligutta in Honnalli *taluk*.

Para. 3 of Memo.

Black Cotton Soil.

6. *Tanks and irrigation of black cotton soil.*—My experience is comparatively small in this matter. But such as it is, it enables me to say that small tanks constructed in black soil do not hold water as long as in the red soil and dry up more quickly. But the beds retain the moisture longer, so that in the case of most tanks, large and small, the black soil bed yields a rich crop of Bengal gram when cultivation is permitted in the cold weather after rains have ceased. Embankments, such as are found in the Chitaldrug District under the designation of *saguvali kattes* help as well to arrest the washing away of surface soil as to conserve moisture for the lands on which they are constructed, and thus no doubt contribute their mite to the maintenance of the sub-soil water-level. I think I have seen high earthen dams as *bunds* of tanks made of black soil, without masonry corewalls but the centre well puddled, the side presented to the water being revetted with stone and the rear slope well turfed.

As regards demand for water on irrigated black soil, I am not sure that I can answer the question categorically. Under the system of survey settlement which prevails here, all land is classed once for all as dry, wet, or garden, and assessed accordingly. Land habitually irrigable is assessed at wet rates, in which the price of water is merged and the assessment is payable irrespective of irrigation (except of course when Government sanctions a partial remission of assessment owing to tank-breaching or the prevalence of widespread drought and distress). There is no system of taking water for irrigation and paying for it or foregoing it and withholding payment as the landholder may choose In this connection the provisions of section 53 of the Land Revenue Code may be referred to, authorising Government to levy an enhanced assessment when water is made available for irrigation at Government expense. In very favourable seasons when there is an ample supply of water in the tank some of the high lying lands, or the more distant lands not ordinarily irrigable, may be temporarily irrigated, and a small water-rate paid for them ; but this is rather because water is available and not because there is a demand for it. In the case of such lands the probability is that water will not be available when there is the demand for it.

The question however may be put in another way or considered in another light in the case of Mysore :—

Are black soil wet lands coveted as much as, or in greater request than, other soil wet lands; and if so, in what circumstances ?

As well as I can can judge, the soil makes no difference in this matter. Other things being equal, I believe that black soil lands are as much in request and quite as much coveted as other soils. For example, I do not recollect any difference in the readiness with which, under the orders of 1886 and 1888, acreage contributions on the principle of betterment were paid or promised for fresh lands commanded by improvements and extensions of the Rampur, Hulhalli, Ramasamudram, Mirle and Saligram series of the Kabeni and Kaveri river channels in the Yedatore and Nanjangud *taluks*. As regards tanks, on the other hand, there are wet lands in some places held and paid for permanently. In other places they are taken up for a season and resigned at the end of the year irrespective of the soil. Some would attribute this to want of sufficient cultivating power in the local community and point to the fact that the *raiyat* cares more for his dry crops than for the rice crop to which he will devote only spare hours. Some will attribute this to uncertainty of water-supply and will point to the fact that there is a rush for these lands only in favourable seasons when rain is abundant and the tank is full. I rather think that it is due to the assessment being heavy. It may be that in these localities the cultivating power is small or that the seasons are fluctuating; but all the same the assessment must be regarded, if not heavy intrinsically, yet, relatively to these local conditions, too heavy to induce *raiyats* to take up the lands and keep them permanently. I have not found that prices make much difference either, though, of course, a high range must in the long run stimulate cultivation. With great fluctuations in the irrigated area in this way, the revenue is also precarious to a corresponding degree. At one time it was ordered that where an entire survey number or recognized share of a survey number of wet land was left uncultivated, half the assessment should be remitted. But this only led to fraud and corruption on the part of local men, and there was nothing to show that it operated as an inducement to keep land permanently in good years and bad.

The case of lands commanded by channels from the recently constructed Borankanave Reservoir (in the Huliyar sub-taluk) might furnish some interesting information on this subject. It is a case of black soil ; and there, owing to local circumstances, it was stated that the people did not care for the water, and would not convert their dry lands into wet, and would prefer to take a little water for moistening their dry crops when the rains fail; and I think it was ordered that water might be given on these terms for one rupee per acre. I have not seen the papers for some time past and do not know what course events took. But I have heard an Engineer complain that they were taking more water for regular irrigation than was calculated upon. The experiences of the Marikanave Reservoir now under construction will be equally interesting. But there is probably no part of the Eastern Division where an irrigation tank will water in the wrong place. Some irrigation works may not be directly and immediately remunerative to Government ; but water storage furnishes other benefits which cannot be commuted into money value ; and those who fear a want of cultivating power may be reminded of the Madras Civilian of a hundred years ago who disapproved of roads for want of carts to take advantage of them. As far as I can judge, there is desire for irrigation works on the part of owners of black soil quite as much as on the part of owners of other kinds of fertile soil. And, where there may be backwardness, I believe it is due in a great measure to the unreadiness of the local landholders to grow crops other than what they themselves consume.

Para. 4 of Memo.

State irrigation works.

7. *Number and description of State Irrigation Works, etc.*—Number and description of the State Irrigation Works, and their total capital cost. Average annual working expenses, and total and net revenue. These are points best and most reliably answered in the Public Works Department.

The Annual Revenue Return 28 A for 1899-1900 furnishes the following statistics of Irrigation works in the State. The return having been but recently prescribed, the figures may not be very accurate and may require some scrutiny and correction. But I believe them to be on the whole reliable :—

I.—Tanks (by designations).

In breached condition.	Class.	Number in good condition.	Under *ayacut* (irrigable area).		Occupied.	
			Area.	Assessment.	Area.	Assessment.
1	2	3	4	5	6	7
			Acres.	Rs.	Acres.	Rs.
6,507	Government .	20,017	752,916	33,41,356	650,277	28,84,273
92	Kodagi . .	1,014	27,457	1,37,185	23,116	1,18,996
336	Inamti . .	1,019	24,976	99,257	23,631	96,919
6,935	Total .	22,090	805,349	34,80,808	697,054	31,00,188

Besides 130 Inam tanks for which statistics are not included in the above.

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II.—Tanks by Survey valuation of irrigable area.

Class.	Number of tanks.	Ayacut.		Occupied.	
		Area.	Assessment.	Area.	Assessment.
		Acres.	Rs.	Acres.	Rs.
Eastern Division.					
1st class with ayacut of Rs. 5,000 and more	23	31,871	1,76,406	27,011	1,51,919
2nd do. 1,000 to 5,000	388	123,464	6,55,455	104,900	5,42,236
3rd do. 500 to 1,000	512	72,713	3,44,120	63,259	3,08,919
4th do. 300 to 500	644	51,003	2,18,036	47,664	2,20,861
5th do. 100 to 300	2,221	92,515	3,97,483	79,602	3,53,413
6th do. 100 and less	4,178	55,736	1,99,080	41,166	1,62,889
Total Eastern Division all classes	8,266	480,332	20,21,769	363,602	17,99,767
Western Division.					
1st class as above	3	7,414	36,052	5,936	20,064
2nd „ do.	95	31,891	1,53,158	28,181	1,44,076
3rd „ do.	298	49,217	2,02,413	40,375	1,85,271
4th „ do.	433	43,475	1,82,997	40,031	1,74,738
5th „ do.	2,150	112,847	4,30,119	101,712	4,01,254
6th „ do.	10,137	130,739	4,53,987	117,209	4,22,105
Total Western Division all classes	13,766	375,116	14,59,036	333,156	13,50,411
Total Province.					
1st class as above	26	39,315	2,12,468	32,947	1,81,013
2nd „ do.	483	155,358	8,09,613	133,081	6,87,212
3rd „ do.	810	121,930	5,46,833	103,634	4,94,193
4th „ do.	1,127	97,478	4,31,033	87,698	3,95,599
5th „ do.	4,671	204,892	8,27,902	181,314	7,57,667
6th „ do.	14,916	186,475	6,53,056	168,375	5,84,494
Total Province all classes	22,032	805,448	34,80,805	697,052	31,00,178

Besides 178 tanks for which class is not given.

III.—Wells.

Nature of Wells.	Number.	Irrigated					
		Already included under tanks.		Not so included.		Total.	
		Area.	Assessment.	Area.	Assessment.	Area.	Assessment.
1	2	3	4	5	6	7	8
		Acres.	Rs.	Acres.	Rs.	Acres.	Rs.
Wells, the property of Government	2,392	1,748	8,018	2,991	7,832	4,740	15,850
Private wells constructed with loans from Government under the Rules of 1891	1,082	990	5,049	3,576	6,179	4.566	11,230
Other private wells	37,403	45,511	2,82,133	41,156	1,51 391	86,667	4,33,528
Total	40,877	48,249	2,95,200	47,723	1,65,405	95,977	4,60,310

IV. Channels including river channels and those drawn from springs more or less perennial such as *talpariges*, etc.—

Number	537
Length . . .	about 1,208 miles.
Irrigable area . . .	Acres 143,098. Assessment Rs. 8,11,032.
Occupied garden area	Acres 19,498. Assessment Rs. 1,14,515.
Dry and wet irrigated	Acres 113,822. Assessment Rs 6,48,803.
TOTAL	Acres 133,320. Assessment Rs. 7,63,318.

As to total area irrigated by the State Irrigation works in a dry year and in a normal year. The area irrigated by river channels has been steadily increasing and as the water-supply is assured practically in all seasons, the latest figures reached may be taken as the area irrigated in a year, *viz.*, 104.154 acres.

As to tanks the average for the ten years 1891-1900 is 487,734 acres. The highest, 522.611 acres, was in 1897-98 and the lowest, 428.877 acres, in 1891-92. The average was exceeded in six out of the ten years.

8. *Their reliability in a year of drought.*—Are these works to be depended upon in a year of drought?

The river channels are to be depended upon. But this cannot be said in respect of the tanks. They will dry up in proportion to size. The smaller ones will of course dry up soon, and so will the large proportion of middling tanks which require sufficient rain to fill them more than once for the year's requirements. The larger ones which hold two or three years' supply may be depended upon in seasons of ordinary drought. The seasons in Mysore are somewhat capricious and the agricultural situation is very much an illustration of the Indian proverb which speaks of a man experiencing a crisis every day and yet endowed with the full measure of the span of life. For a review of the seasons see pages 562-571 Rice's "Gazetteer," Vol. I (2nd edition), paragraph 2 of Mysore Government Proceedings No. 10 D of 10th September 1899, and the Mysore Atlas, 1900, page 8.

Para. 5 of Memo.

9. *Future Extensions.*—Information is best given by P. W. D. Probably river channel extensions, which are the most remunerative, will be impracticable as direct extensions. But there are some likely places where it will be no surprise to me to be told that the practised eye of an enthusiastic Engineer has considered projects practicable whereby ridges may be cut through, and, river floods which now flow unutilized may be stored in reservoirs commanding fresh valleys.

Para. 6 of Memo.

VILLAGE OR PRIVATE IRRIGATION WORKS EXCLUDING WELLS.

10. *Private Irrigation Works, etc.*—It will be difficult to answer this question categorically for Mysore, unless it be to say that private irrigation works strictly so called are mainly confined to alienated tracts (Inam villages, and Jahgirs), and that we have no statistics of them. In Government tracts, besides the channels from springs already referred to in paragraph 5 there are small branches of Government river channels constructed by private landholders who take a remission of one-fourth of the wet assessment on the lands irrigated by them. In Government tracts there are also tanks which were originally constructed, and some of them are still maintained by private capitalists. The enterprise was remunerated by alienations of State revenue either on land assigned once for all as Inam or to the extent of one-fourth the assessment on areas actually irrigated by them. These are called *Kodagi* and *Inamati* or *Hathlaguvad* tanks and their statistics are given at paragraph 7 of this note. These are comparatively old, and now-a-days people do not come forward to construct such.

But in another sense generally the State and the local community are joint-owners of all the tanks in the State. No tank may be breached by the State officers without the consent of and without compensating the local community. When a tank is in danger, State Agency and the local community co-operate in saving it. The *raiyats* are bound to maintain the tanks in fair efficiency. Where large tanks, technically called "Major Tanks," are considerably deteriorated owing to the neglect or poverty of the local communities, they are to be brought up to standard entirely at State expense and then handed over to the *raiyats* for maintenance under the Rules of 1873. Medium tanks, technically called "Minor Tanks," commanding an ayacut of between Rs. 300 and Rs. 100, in similar circumstances are to be brought up to standard by the *raiyats* doing the earthwork and the State bearing the cost of masonry and stone-work, after which the maintenance devolves entirely upon the *raiyats*. Small tanks with an ayacut of Rs. 100 and less are not touched by the State. Under all these tanks, major, minor and small, the assessment is fixed independently of the *raiyat's* contribution to its construction or maintenance. The resources of the State are relatively quite as limited as those of the individual; So that if there be a case in which large and immediate benefit will accrue by a considerable outlay on a work of irrigation, and Government is not prepared to undertake it entirely at State expense, the men benefited pay cash contributions on the principle of "betterment." In all cases the fish in the tank and the grass on the rear slope of the *bund* belong to the local community. It often happens that when a tank is about to dry up, and the fish are likely to die, the latter are sold for money which is afterwards spent on earthwork to the tank, or for direct earthwork itself at so many cubic yards of earth excavated in the bed or in the neighbourhood and laid on the bund. These are the traditional principles governing tank-works in State tracts, and upon them rest the rules of 1873 and 1885-86. These rules have sometimes been complained of where the traditional practices and agricultural instincts of the *raiyats* have been tampered with. Sometimes also hardship has been caused by the local officials lacking the tactful and presistent effort necessary to take tank work from the *raiyats* in moderate quantites and at seasonable times without prejudice to their cultivation engagements. But all the same a vast deal of good work has been accomplished under these rules and traditional practices. The number of minor tanks alone so dealt with has been as shown below:—

1891-92	482	1895-96	1 058
1892-93	608	1896-97	1,192
1893-94	525	1897-98	1,125
1894-95	1,073	1898-99	1,283

And on behalf of the *raiyats* it is essential that the local executive should see that the necessary stone and masonry-work in all cases follows close upon earthwork; otherwise an appreciable portion of the latter would be washed away by rain and the *raiyats'* labour destroyed. See Administration Reports, 1886-91, paragraph 720; 1891-95, paragraph 410; 1895-99, paragraph 613.

Some people object on principle to the exaction of *raiyat's* labour on tank work. Such may be asked to pause to answer the question how else are so many tanks so vital to the community to be maintained. The State cannot afford it. The necessary funds cannot be raised by enhanced land assessments or additional taxes because the people cannot pay them. Putting it in another way: the economic value of the labour devoted to tank work is great. If the community be relieved of it, they are not in a position to earn that value by devoting the labour saved to other occupations. It is practical statesmanship to harness it to subserve the public good.

In this connection the old *kerebandi* system may be referred to, under which there was a man for each important tank with emoluments in the shape of a small Government land free of assessment, whose duty it was to keep a buffalo or two and on its back convey earth to worn out parts of the tank bund. The system is worth reviving as it furnished timely attention to the bund while the *raiyats* were otherwise occupied. Even after its abolition in State tracts it has been working in some Inam villages apparently with good results.

Para. 7 of Memo.

Crops irrigated, etc.

11. *Crops irrigated.*—What are the crops usually irrigated in each season by (1) canals (2) tanks and (3) wells.

The agricultural seasons are two in number, and the produce is called Kartik crop or Vaisakh crop according to the time of ripening. (Kartik falls in October and November; Vaisak falls in April and May.)

The crops usually raised under canals are rice and sugarcane, the latter only when a hot weather supply is given. The gardens commanded by canals obtain moisture in the hot-weather by occasional watering either direct from the

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canal or supplemented from wells sunk in the gardens themselves. Supari, cocoanut palms and plantain form the chief garden products under canals.

Under tanks the chief crops grown by direct irrigation are also rice and sugarcane, the latter when a hot-weather supply is assured either by the abundance of water in the tank or by an economical use of the available water-supply such as may be locally agreed upon by the landholders interested. Other miscellaneous crops are also grown in favourable localities, such as wheat, corriander, garlic, etc. Vast stretches of cocoanut and arecanut gardens are often dependent upon tanks supplemented by wells under them. Betel-vine, mulberry and minor garden produce are also grown in them. The vicinity of tank and canal bunds affords moisture for the growth of ground-nuts.

With well-irrigation, most of the minor garden produce such as potatoes, onions, garlic, chillies, corriander, turmeric, ginger, etc., are produced in the State. Wheat, rice, ragi and jola are also frequently cultivated under well-irrigation in parts of Tumkur and Chitaldrug districts. Coffee, where it is cultivated on a small scale in the vicinity of Bangalore, is irrigated from wells in the neighbourhood of tanks. Vegetables are extensively cultivated with the aid of wells. Plantains, betel-vine and black pepper are supplied with moisture from wells during the hot season.

12. *Distribution of water.*—During what period is water given out? How is the distribution from canals and tanks controlled, and the time for which water is allotted to each cultivator determined?

All the channels are open for the irrigation season from the 1st June of every year to about the 10th January following for rice cultivation. The head sluices are closed on the latter date for silt and weed clearing and occasional repairs. During the close season water is let into the channels for a week every month for a hot-weather supply to gardens and sugarcane crops. In some places this is availed of for the cultivation of green manure crops of sort on fields to be afterwards planted with rice or sugarcane.

The head sluices are always in charge of the Public Works Department, whose officers regulate the flow in the channel with reference to irrigation requirements on the one hand and to the state of the weather on the other (very rainy, etc) The minor distribution during the irrigation season is under the Revenue authorities. The time for which water is allotted to each cultivator is determined much by local usage and arrangement. It is seldom that there is any dispute in this respect, as, in the first place, the discharging sluices are fixed in channel bunds in convenient sizes and at convenient distances to minimize difficulty in subsidiary distribution; and in the second place the subsidiary channels are laid out and excavated before the blocks of land assigned to a sluice are brought under irrigation. Any little dispute that may still arise is settled by a local *punchayet* or by the Shekdar and Amildar under the general direction of the Deputy Commissioner. And in most cases there are hereditary village servants (nirgantis) or salaried officials, such as manager, sowdie, etc., to help the *raiyats* in the distribution of water. Water used for irrigation is not paid for by quantity and time, but at an acreage rate in addition to the dry assessment or merged in a wet or garden assessment.

As regards tanks, they are entirely under the Revenue authorities. The quantity and the period of water supply are much the same as under channels. The arrangements for the minor distribution are also the same. No difficulty arises when a tank holds an ample supply of water, for then landholders raise rice or sugarcane crops as suits their convenience and resources. But when the supply is less, so as not to suffice for the entire irrigable area assigned to it, it happens either that as much as possible of the lands lying nearest to the tank-bund is cultivated, the rest being left waste, much to the dissatisfaction of the owners of the latter, or that an amicable arrangement is come to by all the landholders concerned whereby all co-operate in cultivating sugarcane and making *gur* out of it. It thus happens in some tracts that a season of normal rainfall and tank supply means a season of more rice and less sugarcane cultivation.

13. *Duty of water.*—As regards the average duty of water, by which I understand the area it could or is calculated to irrigate, the Public Works Department are best able to give information. It should vary so much with the kind of soil and sub-soil, with the kind of crop grown, and the method of watering it, and with the general lie of the fields relatively to each other, and to the discharging sluice, that there must be more than one formula on the subject; so that, what will suit the circumstances of one locality is not likely to suit another. Needless to add that it must vary also with the rainfall and temperature of the seasons, and from what I have seen on the old and the more recent channels drawn from the Cauvery, Kabbani and Hemavati rivers, the area irrigable by the same quantity of water will be more under the former where the lands have been longer under irrigation than under the latter. Good and bad terracing of the lands also makes a great difference, as well as the traditional habits and experience of the cultivators, in respect of the crop raised. And lastly, it is notorious that under well irrigation all things contribute to a more economical use of water than under tank or canal irrigation. In respect of insufficiency of water-supply from canals and tanks there is great friction between the Public Works and Revenue Departments, and the best officers on both sides are often at variance. In the case of tanks a system of remitting half the wet assessment on lands left entirely waste has already been referred to in this note. In the case of canals a remedy was devised by instituting the system under which the distribution is placed under Revenue officers during the irrigation season just as tank water distribution always is. But in my opinion this has not answered its purpose. It seems to me that, for one thing, fresh and careful experiments, numerous and continuous, should be made, and that, for another, there should be an occasional drafting of a Public Works Department officer to the Revenue Department The Revenue Department acquired or has inherited advantages by the employment of military officers on general duties. The police and revenue services have equally benefited by the interchange of officers between them, and so have the Survey Settlement and Revenue services benefited, and there is not that friction or divergence of views between them that existed here at one time before such interchange, or that exists elsewhere. And I do not see why similar good should not result by occasionally employing an Assistant or Executive Engineer who combines good administrative capacity and engineering skill as a Revenue Sub-Division Officer or Deputy Commissioner. With a few such instances, it may well be hoped that while the people will be better assisted in works which they have to carry out themselves, both Public Works and Revenue Departments will understand things and each other better and act on concurrent and convergent lines in all matters in which they have to act respectively as investors and realisers of Government revenue and co-operate as administrators of famine relief.

Para. 8 of Memo.
Statistics for Typical Works.

14. *Statistics for typical works.*—Information will be best furnished by the Public Works Department where alone most of the data are available.

Para. 9 of Memo.
Flood Protection, etc.

15 *Flood protection and drainage work.*—I know of no place where flood protection and drainage works are required in the sense probably contemplated in this question. No where that I know of is agricultural land liable to be inundated by floods prejudicial to the cultivation except in parts of the Hemavati Valley and in fewer places in the Cauvery and Yagachi Valleys. These exceptions are negligible. On sanitary grounds drainage works are required in parts like Yedatore, Sosale, etc. But these towns being situated in the midst of rice cultivation, the probability is that in these cases drainage works will not be sufficiently protective, and that it would be necessary altogether to shift the towns.

Para. 10 of Memo.
Relief Works.

16. *Relief works.*—Full information will be available only in the Public Works Department. I can only state here that Mysore has not known any famine of magnitude since 1876-78. There was some distress in 1891-92 and 1896-97. On all these occasions tank work was, as probably it will ever be found to be, the most suitable employment for agriculturists in need. The earthwork on parts of the Bangalore-Mysore Railway furnished excellent employment to famine labourers in 1876-78, and that on the Bangalore-Hindupur Section in 1891-92. But there is a limit to railway projects, and they are unsuited to times of ordinary or partial drought, as they would entail on the part of labourers prolonged absence from their homes, which among other evil things means also prolonged absence from their fields and neglect to make the most of favourable rains which are not wanting in the worst of years. Collection of road material in advance of requirements has also employed famine labour. But unsuited as this class of labour is to the cultivating *raiyat*, it possesses other disadvantages. In the case of tanks on the other hand they are numerous,

their storage capacity is increased, and as they are mostly dry in seasons of drought or famine, earth can be excavated in the bed itself to be placed on the top and rear of bund. This is the work which the *raiyat* understands and which benefits the local community directly and which therefore they are all the more interested in seeing completed early, if not completed before famine is past.

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(7) Mr. K. Ram Chunder Rao, retired Sub-Division Officer, Chikballapur Sub-Division, Kolar District. *Mr. Ram Chunder Rao.*

(Answers to printed questions.)

1. On the 29th ultimo I was favoured with the Government Secretary's Circular Proceedings No. R. 820—33 of the 26th idem giving cover to the set of questions by the Irrigation Commission of the Government of India.

2. From the N. B. of the question paper and the tenor of question No. 1, I understand that only such officers as possess a personal knowledge of a particular district, or a portion thereof, are competent to answer the queries.

3. Up to June 1896 I was Assistant Commissioner in several districts excepting Mysore, Bangalore, Chitaldrug and Kadur, on general duty, without having executive charge of any portion of a district, most part of the work being the trial of a large number of criminal cases. From 1st July to December 1896 I had charge of the Sagar Sub-Division for six months only. I then presided over the Closepet Sub-Division only for ten months, and then the Chikballapur Sub-Division for only six months up to July 1898, when I was retired. This circumstance rendered it impossible for me to acquire that extent of personal knowledge of any particular portion of a district which would enable me to bear my direct testimony to the condition and circumstances thereof.

4. I would however beg leave to submit the following report based on my knowledge of a general character and on my notes of the official records which I had studied during my employment in the Government Secretariat and the outlying districts to which I stood posted from time to time, with a hope that it may throw some light at least on some of the points under enquiry.

5. Mysore is purely an agricultural country, its welfare depending on better condition of the numerous tanks with which the whole surface of the country is studded. These works are of very great antiquity. As a rule they are not single reservoirs. They are so peculiarly situated one below the other in chains consisting of a large number, that the upper tanks discharge their surplus to those immediately below them, and that the failure of any tank above another which is at the same time overflowing, would probably breach the lower tank; the united waters of these breached tanks would suddenly rush into the next below and carry away the bund of that also; and so would they go on breaching one after the other all down the chain. According to Colonel Fankey's report in 1866, out of 27,209 square miles covered by Mysore, 16,287 miles, or nearly 60 per cent. have the drainage intercepted by tanks which were built by the patient industry of its inhabitants and which so cover every part of the country that it is extremely difficult to find a suitable site for a new tank.

6. The one largest tank which deserves being called a lake is Sulekere in the Chunnagiri *taluk* of the Shimoga district, whose irrigable area, as noted by me in 1875-76 when I was Manager of the Nagar Division, Commissioner's office, is 1,975 acres, assessed at Rs. 6,534-8-0. The bund of the tank is recorded 1,000 feet long, 84 feet high, having a breadth of base of upwards of 600 feet, it being 40 miles in circumference. With a few more exceptions, all other tanks are within Rs. 5,000 revenue. All tanks having been correctly numbered in 1874, it has been ascertained that there are altogether 37,980 tanks in the Province, classified as follows:—

Class.	Annual Revenue.	Number of tanks.
	Rs. Rs.	
I	Above 5,000	10
II	Between 4,000 and 5,000	12
III	Do 3,000 „ 4,000	8
IV	Do. 2,000 „ 3,000	45
V	Do. 1,000 „ 2,000	167
II	Do. 500 „ 1,000	548
II	Do. 100 „ 500	4,94
II	Do. 50 „ 100	4,344
IX	Below 50	14,281
X	Yielding no revenue	13,620
		37 980

7. It will be seen from the above that, deducting 13,625 comprised in Class X, the revenue-fetching tanks number only 24,355, of which 18,621, or more than 76 per cent., are within an annual revenue of Rs. 100. A great majority of the tanks in Mysore are entirely dependent on a capricious rainfall for their supply of water, there being only a few tanks fed by perennial rivers. It is a regretable circumstance that a very large percentage of our tanks are in a neglected condition. During the period anterior to Haider Ali's usurpation of the sovereignty of Mysore in 1760, these works were in a flourishing condition under the administration of the ancient Rajas of Mysore and other Pollegars who were subdued subsequently. From the time of Haider Ali down to 1799, when Tippu's reign ended, the tanks suffered most seriously. In his report in 1866, Colonel Sankey, the then Chief Engineer, stated on best authority that under Tippu's Government, tanks were frequently breached as a military necessity or to gratify a whim.

8 The next epoch was that of the celebrated Minister Purnaya's regency from 1799 to 1810. According to the British Resident Major Wilks, the tanks were, at the time of the Dewan's assumption of the regency, universally in a most lamentable state of decay, and those which had been broken and disused many years ago were visible in every part of the country. By undivided attention and judicious management the Dewan Purnaya succeeded in getting hundreds of the ruined tanks completely restored. It would appear from Major Wilks' observation that good many tanks which, owing to the overgrowth of jungle, had been forgotten or unknown, were now reconstructed. The Dewan spent on the average a sum of nearly three lakhs of rupees per annum on irrigation works as particularised below with a small establishment of 25 *maramat mutsaddies* at a cost of 153 Canteroy pagodas, equal to Rs. 436 a year, enforcing, according to the ancient custom, the responsibility of the *raiyats* for affording their free labour—

	Year.	Expenditure on Irrigation Works. Rs. a. p.
1	1799-1800	3,86,670 8 9
2	1800-1801	4,48,496 0 7
3	1801-1802	2,78 197 8 5
4	1802-1803	2,17,762 14 7
5	1803-1804	1,90,836 5 10
6	1804-1805	3 69,355 10 3
7	1805-1806	3,36,018 6 9
8	1806-1807	2,76,363 10 3
9	1807-1808	3,00,742 15 9
10	1808-1809	1,89,409 11 10
11	1809-1810	1,53,389 12 8
	Total	31,47,243 9 8

9. The next period of native management of the tank system was the late Maharaja Krishnaraj Wadeyar's administration from 1811 to October 1831, when, in consequence of his general misrule, the British Government assumed the country and placed it under the control of the Chief Commissioner. No accounts showing the expenditure incurred on irrigation works during this period are forthcoming, the disbursements of all kinds being lumped together. It is on record that the works, as years advanced, were allowed to fall into that degree of decay that when the British Commission assumed charge, they were found to be in the most deplorable condition.

10. From the year 1831 to 1856 the restoration and maintenance of tanks received great attention. The management was entirely left in the hands of four European Superintendents of four administrative divisions acting under the orders of the Chief Commissioner, Sir Mark Cubbon, who adhered to the native principle of enforcing *raiyats'* obligations to do certain amount of unskilled work to the tanks. This was in consonance with the view expressed by the Court of Directors of the Honourable East India Company in their letter of 25th September

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1835, in which they stated that they were desirous of adhering, as far as can be done, to the native usage and not to introduce a system which cannot be worked hereafter by native agency. In the first three years of the British Administration there was no Public Works Department officer at all. Works to the extent of a lakh of rupees were carried out by the agency of the Amildars under the immediate control of the European Superintendents. It was only in 1836-37 that a Public Works Department officer under the designation of Maramat Superintendent with his subordinate staff of two Surveyors, four Assistant Surveyors, five Sub-Assistant Surveyors, twelve Apprentices and seven Maistries for the whole province was appointed. The execution of works was exclusively in the hands of Revenue officers, the Maramat Superintendent of the Province being consulted in matters involving questions of engineering science. A sum of Rs. 19,97,291 was laid out on tanks during the said period of 25 years, the average being nearly Rs. 80,000 per annum. According to the report of Major Green, Maramat Superintendent, in June 1855 the state of the tanks was in a fair working order up to that year; tank bunds which broke and remained useless previous to the British assumption were all nearly restored.

11. A great change took place in 1856-57 by the formation of the new Department of Public Works, and the Revenue officers' divestiture of the execution of all public works. The proposal for this change did not originate from the Chief Commissioner. The large surplus of Rs. 55,56,321 remaining in the Treasury at the close of the year 1853-54 attracted the attention of the Honourable Court of Directors, who, with an expectation of promoting the development of the resources of the country, ordered the construction of the Department of Public Works, composed of one Chief Engineer, 5 Executive Engineers, 4 Assistant Engineers, 30 Supervisors, Overseers and Surveyors. This measure raised the cost of establishment from Rs. 62,000 in 1854-55 to Rs. 2,52,000 in 1855-56. The Revenue officers handed over to the new department the share which they formerly had had in superintending public works, and awaited the result. The clash and discussion between the officers of the two departments proved detrimental to the interest of the Government.

12. The result of the working exclusively by Public Works Department for a period of eight years from 1855-56 to 1862-63 convinced the Chief Commissioner Mr. Bowring of the inexpediency of the change made in 1855-56, and that the new department had undertaken far more than it was able to manage. A majority of the tank repairs throughout the Province was therefore taken away from the hands of the Public Works Department and entrusted to the Revenue officers, with a small subordinate establishment, defining their power to deal with all minor repairs of the tanks up to the limit of Rs. 500 on each work, the Chief Commissioner's power of sanction being fixed up to Rs. 10,000, subsequently raised to Rs. 20,000. This arrangement received the approval of the Government of India in their despatch No. 4991 of the 15th December 1862, in which they pointed out that it was desirable to transfer, as much as possible, the care of minor tank repairs to the Revenue Department.

13. The decision of Her Majesty's Government in April 1867 for the restoration of the country to the Native rule prompted the Chief Commissioner Mr. Bowring to devise measures for successful prosecution of irrigation works before the Rendition in 1881 when the late Maharaja Chamarajendra Wadeyar was to attain his majority.

In this view, he made enquiries as to the actual condition of the tanks throughout the Province at that time. Colonel Sankey, the then Chief Engineer, reported that it was a sad enough spectacle to look around and see thousands and thousands of ruined tanks. The Executive Engineers of all the divisions reported that half the number of tanks in their respective divisions were either breached or in need of thorough repair. Opinions varied as to the remedial measure to be adopted for restoring these works to order. The view taken by the Public Works Department officers was that the entire control or interference of the Revenue officers who were wanting in professional knowledge should cease, and that a Special Irrigation Department composed of Superintending and Executive Engineers should be formed for the purpose of carrying out the serial system of tank restoration under which each chain of tanks was to be brought to a standard of safety and made over to *raiyats* for future upkeep. Quite antagonistic views were expressed by the Revenue officers. The Chief Commissioner, Mr. Bowring, held that all the great irrigation works in Mysore, both tanks and channels, were constructed by the people of the country, and that several existing works of 400 years' duration were the best evidence of the solidity of the structures and the ingenuity of the builders; and recommended the enhancement of the powers of Revenue officers in respect of the execution of public works by placing Executive Engineers and Assistant Engineers in subordination to the Divisional Commissioners and the Deputy Commissioners, to be their professional advisers, and the entertainment of a *maistry* and *mutsaddi* for each of the 83 taluks of the Province for prosecution of works under the immediate orders of the Amildars. Mr. Bowring further advocated that to bring up to uniform standard even one drainage, as proposed by the Chief Engineer, would be a costly business and a very long one, and that the policy of enforcing *raiyats'* obligations for upkeep should be strictly adhered to. This formed the subject of much correspondence up to the latter end of 1870, when the Secretary of State for India, in his despatch No. 77, observed that unanimous opinion among all the officers consulted on the subject existed in favour of the restoration of the management of the thousands of small tanks throughout the country to the village communities; and that the failure of the Public Works Department to keep the tanks in proper condition was universally admitted by the local officers, the experiments of the results of its agency since 1856 having failed, and directed that a well-considered scheme for the repair of small tanks under the agency of the Revenue officers should be adopted throughout the State. After further correspondence, the establishment of additional Irrigation Engineers with their subordinate staff was sanctioned by the Government of India for carrying out the serial system which came into operation in 1872-73. The Revenue officers continued to manage the minor tanks within their powers of sanction with a small establishment under them. In 1872-73 nothing beyond preliminary surveys was done in the execution of the new scheme. Only a couple of years after the partial working of the scheme, the unprecedented famine of 1875-76 occurred, and the attention of both the Public Works Department and Revenue officers was directed to the relief operations. Major Moncriff, the then Chief Engineer, and Mr. Elliott, the Famine Commissioner, as well as the Chief Commissioner, Sir James Gordon, concurrently held that the serial system of the tank restoration must, in spite of its theoretic excellence, necessarily be abandoned owing to the enormous outlay and great length of time involved; the completion of one of the eight districts of the Province according to the said system having been estimated to cost 72 lakhs of rupees and occupy full 30 years. Having regard to this circumstance, and the lamentable financial condition to which the State was subjected from the effect of the famine, considerable reductions were made in the establishment of the Public Works; the Revenue officers were divested of the execution of minor works, and one Executive Engineer for each division was made responsible for all classes of works, whether irrigation, road, building or Local Fund work. The plan was approved of by the Government of India, with a remark that the authority of the Deputy Commissioner should not be unduly diminished. This new scheme was introduced from 1879-80 and remained unaltered up to March 1881, when the 50 years' direct administration by the British Government terminated, in consequence of the Rendition of the country to His Highness the late Maharaja Chamarajendra Wadeyar.

14. In October 1881 the Government received representations from people that the tanks were in a neglected condition, and the late Dewan Mr. Rangacharlu informed them that the matter would receive early consideration and that he attached great importance to the villagers and to the *taluk* authorities on the spot being empowered to carry out the necessary repairs promptly and without needless references. The subject was again mooted in 1884, when the late second Dewan Mr. Sheshadri Iyar observed that the Government could not conceal from themselves the fact that out of 38,000 tanks in Mysore a large number were now in complete ruin, and that this failure of tank management was due to the non-recognition of the important principle of the *raiyats* being made to take joint interest in the conservancy of this chief source of irrigation. In the following year a scheme for enlisting the co-operation of the *raiyats* in the matter of the repairs of tanks yielding a revenue of less than Rs. 300 was tentatively introduced into eight selected *taluks*, one in each district. The main feature of the scheme was that the *raiyats* concerned were held responsible to do the earthworks portion of the tapair, the cost of the stone and brick works being borne by Government. The result was success in the five *taluks* of Nelamangala, Sira, Challakere, Mandya and Shimoga; and failure in the other three taluks of Arsikere,

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18. *Question No. 4.*—The Chief Commissioner Mr. Bowring's circular No. 227 of 31st March 1863 is the standing authority concerning the restoration of tanks and wells by private individuals. It allows the restorer the privilege of either paying three-fourths of the wet land assessment, or highest dry rate prevailing in the village. The liberality of the rule is unquestionable. As to what further should be done in this matter, I will notice in dealing with question No. 32.

19. *Question No. 6.*—The extension of irrigation does not tend to injure the remaining cultivation by attracting its cultivators to the irrigated tracts. I must, however, observe that dry land cultivation is more extensive and attractive for these reasons.

Ragi grown in dry land is the favourite food of nine-tenths of the population which, according to the present census of 1901, numbers 5,538,481 souls; the dry grain is considered the most certain crop in the climate of Mysore. From the statistics for the years from 1895-96 to 1899-1900 which have been published in the *Mysore Gazette*, I make out that the average extent of food-grain cultivation including rice, ragi, cholam, etc., is 5,131,509 acres, while that of rice cultivation alone is 722,544 acres, *i. e.*, only 15 per cent of the former. It is true that in 1855 the then Chief Commissioner Sir Mark Cubbon has stated in one of his reports to the Government of India that wet cultivation, except under perennial river channels, was looked upon with disfavor and followed with aversion. But there has been subsequent change of circumstances. Opening of roads and railways, and the conversion of Batayi system (under which Government and the *raiyats* were to divide the produce of the wet land in equal halves) into fixed money assessment, added to the high prices of rice and sugar, are undoubtedly great incentive for the *raiyats* to cultivate wet lands for the purpose of earning money, without, of course, neglecting their dry land cultivation to get the staple article of their food, *viz.*, ragi.

20. *Question No. 23.*—Most of the tanks in Mysore depend upon seasonable rains for their supply. There are very few tanks fed by rivers. As a rule most of the tanks have a class of servants known as *nirgantis* attached to them. These servants regulate and distribute water to the fields. Some tanks have no *nirgantis*, a want which it is necessary to supply. Complaints have been often heard that, in the absence of proper supervision, some cultivators are apt to do mischief by closing the small distribution channels, unnecessarily utilizing more water than needed, to the detriment of other's lands below, and other similar acts. A set of defined rules exist (*vide* Chief Commissioner's Notification No 326, dated 13th March 1874), as regards river channels. In Government Proceedings No. 11671-78—3868 of the 30th June 1897, it has been held that the said rules might be made applicable to tank channels also. A legislative provision with penal clause both as regards river and tank channels would, I am sure, put down the evil practice complained of. Majority of our tanks are not capable of holding more than 6 months' supply of water in a year of ample rainfall, three months' supply in that of scanty rainfall, and one month's supply or nothing at all in a worse season. As regards the area ordinarily irrigated by a tank, there is no precise information with me. Some approximate estimate may, however, be made from the table appended to paragraph 6 of this memorandum in which it is shown that the majority of our tanks yield revenue below Rs. 100 I am in possession of information as regards the Survey Settlement wet rates in the following 22 taluks:—

No.	Taluk.	Minimum rate per acre.	Maximum rate per acre.
		Rs. a. p.	Rs. a. p.
1	Kolar	3 12 0	6 0 0
2	Tumkur	9 0 0	10 0 0
3	Sira	8 0 0	9 0 0
4	Shimoga	5 0 0	6 0 0
5	Tirthahalli	5 0 0	6 0 0
6	Channagiri	.....	8 0 0
7	Sagar	4 12 0	5 8 0
8	Nagar	4 4 0	5 8 0
9	Sorab	5 8 0	6 4 0
10	Honnali	5 8 0	6 0 0
11	Shikarpur	5 8 0	6 8 0
12	Davangere	5 0 0	6 0 0
13	Chikmagalur	6 0 0	7 0 0
14	Kadur	6 0 0	7 0 0
15	Mudgere	3 8 0	6 0 0
16	Koppa	4 0 0	5 8 0
17	Tarikere	5 0 0	5 8 0
18	Hassan	7 8 0	8 0 0
19	Manjarabad	4 0 0	7 8 0
20	Belur	7 0 0	8 8 0
21	Arsikere	7 8 0	8 8 0
22	Seringapatam Palhalli	...	8 0 0

Adopting, for the purpose of rough estimate, the rate of Rs. 4 per acre, the ordinary area of a tank may be put down at about 25 acres.

21. *Question No. 24.*—By having two harvests instead of one, the wet landholder would secure cent per cent increase of income. Rice and sugarcane are generally grown in irrigated lands; the former is less valuable than the latter which requires more water and time. Taking into account the quantity of produce and market-value of both the articles, the increase of value by the substitution of sugarcane for rice is also cent per cent.

22. *Question No. 25.*—The too late commencement of wet crop cultivation for want of timely supply of water would result in the diminution of the produce to the extent of 50 per cent. The result of the too early cessation of water-supply would ordinarily be complete failure of the crop. In some instances 12½ or 25 per cent. of the ordinary outturn may be secured.

23. *Question No. 27.*—To answer this question it is necessary to know what is the ordinary outturn of an acre of dry or unirrigated land and what that of an acre of wet or irrigated land. In 1878, Mr. C. A. Elliott, the then Famine Commissioner, made a very careful investigation and arrived at the conclusion that the outturn of a dry crop acre would be two Krishnaraj khandis or 320 seers equal to 640 pounds, and that that of a wet crop acre would be 3, 4 or 5 Krishnaraj khandis equal to 960, 1,280 or 1,600 pounds. The following is an extract from Mr. Elliott's memorandum:—

"The returns I have received from the *taluks* put the average produce at figures varying from 1½ khandis to 5 khandis per acre. As the average productive quality of the soil of different *taluks* does not vary at all like this, I cannot put much reliance on these estimates. The general way of calculating produce among the cultivators is by so many fold the seed sown; and the ordinary answer I have received to my question is that the return of an average field of ragi is 40-fold, and this too is borne out by the figures in Buchanan's Mysore. The lowest reply I have received is 30; the highest 60. Now 40-fold or 40 khandis of 13 acres gives 3 khandis per acre, but taking the actual average of 24 acres, it is less than 2 per acre I should mention here that I am speaking of the common or Krishnaraj khandi of 160 seers. The returns kept in the office of the Commissioner of Nandidrug give an average outturn over three years for the three districts of the division, of 594 pounds per acre. Colonel W. C. Anderson, the Revenue Survey and Settlement Commissioner, states that he considers 600 pounds per acre a very moderate estimate. On the whole, therefore, allowing for the subsidiary grains and also for the fact mentioned above that all the occupied land is not actually cultivated, I think it is a safe estimate to reckon the outturn of a dry crop acre at 2 khandis, or 640 pounds. For wet, *i. e.*, rice lands, the estimates vary a good deal; some *taluks* declare that the outturn is as low as 10-fold, but most calculate it at 20-fold, and in the richest lands and those irrigated by the Cauvery river channels, it is generally estimated at 40-fold. Ten khandis for a khandi of seed means 5 khandis of paddy or 2½ khandis of rice per acre, and I think it is idle to assert that a field well watered and paying four or five times the revenue of a dry field produces only the same amount of food-grain. I have had no opportunities of testing the actual outturn of any rice lands; but putting together all that I have read and heard, I think the lowest estimate that can be framed is 3 khandis of rice per acre; and in *taluks* where the cultivation of rice is good and the water supply assisted by river channels and wells, I put it at 4 and even at 5 khandis."

In 1872-73 an experiment made by a Revenue Survey Officer in one of the *taluks* of the Shimoga district under special directions from the Revenue Survey Commissioner, by carefully measuring, at harvest time portions of rice fields taken at haphazard, and having the crops thereon cut and thrashed out entirely under his own eye, proved that the outturn of paddy was 880 seers or 1,760 pounds per acre. I myself made a series of such experiments of rice and ragi crops ready for sickle during my annual tours for *jamabandi* of some of the *taluks* in the several districts where I had been employed. I tabulate below the results which I then found and which were duly noted by me :— *Mr. Ram Chunder Rao.*

Description of land.	Date of experiment.	Character of the season.	Particulars of the fields experimented upon.	The area of the crop land measured.	Quantity of grain obtained in seers of 80 rupees weight.	Proportionate outturn per acre of 4,840 square yards based on columns 5 and 6.	
						In seers of 80 rupees weight.	In khandis of 160 seers.
1	2	3	4	5	6	7	8
Wet lands irrigated by tanks.	2nd April 1887.	Favourable	Hongalwadi Patel's land below Gaudee tank, Arsikere Taluk, Hassan District.	1 square yard.	$\frac{27}{80}$	1,633	10 khandis and 33 seers.
	3rd April 1888.	Do.	Patel Kadarareddi's land below Ronur tank, Srinivaspur Taluk, Kolar District.	1 Do	$\frac{39}{80}$	1,694	10 khandis and 94 seers.
	24th March 1890	Do.	Shanbhag Subrayappa's land below Hudagur tank in the Goribidnur Taluk, Kolar District	$\frac{121 \text{ yards or } 106}{40}$ an acre.	12 seers .	480	3 khandis.
	5th Jan. 1889.	Do.	Chikarauga Rao's land below Somesera tank, Mulbagal Taluk, Kolar District.	20 yards .	6 do. .	1,452	9 khandis and 12 seers.
	1st Dec. 1892.	Do.	Kasim Sab's land below Palvalli tank, Pavagada Taluk, Tumkur District.	25 do. .	5 do. .	960	6 khandis.
	18th May 1892.	Do.	Venkanna's field watered by a well in Pavagada Taluk, Tumkur District.	25 do. .	6 do. .	1,160	7 khandis and 40 seers.
	21st Nov. 1894.	Do.	Jayachar's No. 198 below Nidagate tank, Tirthahalli Taluk, Shimoga District.	$\frac{121 \text{ yards or } 1}{40}$ acre.	20 do. .	800	5 khandis.
	4th Dec. 1897.	Do.	Govindappa's No. 195 below Gudibanda tank in the Kolar District.	Do. . .	16 do. .	640	4 khandis.
Khushk or dry fields.	8th Dec 1891.	Drought .	Chikanna's dry field No. 66 in Tumbadi of the Koratagere Taluk, Tumkur District.	25 yards .	$\frac{25}{80}$	60	Owing to the drought it was $\frac{1}{8}$ crop $\frac{40}{160}$
	15th Dec. 1891.	Do. .	Timmanna's dry field No. 5 in Tippagondanahalli village, Madagiri Taluk, Tumkur District.	25 do. .	$\frac{60}{80}$	145 seers .	Owing to the drought $\frac{1}{4}$ crop $\frac{145}{160}$
	24th Nov. 1895.	Favorable	Nagesa Rao's dry field No. 75 in the Islapur village of the Shimoga Taluk in the Shimoga District.	30 do. .	2½ seers .	400 do .	2½ khandis.
	15th Nov. 1897.	Do. .	Venkatsetti's dry field No. 94 in the village of Honnanaikanahalli in the Channapatna Taluk of the Bangalore District.	$\frac{121 \text{ do. } 1}{40}$ acre.	17 do. .	680 do. .	4¼ khandis.
	4th Dec. 1897.	Do. .	Subbasastry's land in Subbenahalli, Chikballapur Taluk, Kolar District.	30 yards .	2½ do. .	400 do. .	2½ khandis.

The results of these experiments made under my own eye confirm Mr. Elliott's figures to a great extent. I must however, beg to state that the average outturn of an irrigated rice field is not less than six Krisnaraj khandis per acre in an ordinary season. In favoured localities and fields irrigated by perennial river channels it may go up to 10, 12 or 15 khandis. Under one of the Cauvery channels in Palhalli in the Seringapatam *taluk* I myself own three survey numbers, *viz.*, 21, 113, and 123, measuring in the aggregate 7 acres, assessed at Rs. 60 plus the local cess of one anna in the rupee. Under a registered bond, I have been receiving from the cultivator 10 khandis of paddy annually as landlord's share, which gives an average of 5⅐ khandies per acre. Taking into account the cultivation expenses and labour borne by the cultivator and the margin of his profit it may be safely assumed that the yield cannot certainly be less than 10 khandis. I would, therefore, safely adopt, for the present purpose, the yield of 2 khandis of ragi per acre of dry or unirrigated land, and 6 khandis of paddy per acre of wet or irrigated land. I now compare the value of the produce of a dry land with that of an irrigated land.

The 2 khandis of ragi produced in an acre of dry land fetch, according to the average market price, a sum of Rs. 16, whereas the 6 khandis of paddy got from an acre of irrigated land realize an average price of Rs 36. The approximate estimate of the increase from conversion of a dry land into wet cultivation by means of irrigation is 125 per cent.

21. *Question No. 28.*—When a tank or other source of irrigation is restored by any private person, the dry land cultivators benefited by such irrigation pay to the owner the full rates of wet assessment prevailing in the village, which ranges from Rs. 3 to 8 per acre as shown in paragraph 20 of this memo., the owner paying three-fourths of the same to Government as explained in paragraph 18. When the restorer of the tank is himself the owner of the lands thereby irrigated, the person cultivating the land as his tenant pays to the owner either half or one-third of the produce in kind, or any fixed amount of grain or money according to their special agreements. The most common practice is for the tenant to give his landlord half the produce, which is known as "Wara" system. The owner of the land under a Government irrigation work pays to Government the full rates of wet assessment in addition to local and irrigation cesses annually. When any new irrigation project is carried out by Government at a cost of Rs. 25,000 and upwards, the dry landholder benefited thereby is bound to pay Government, once for all, a lump sum contribution

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varying from one-third to one-fifth of the difference between the local market values of an acre of dry land and of an acre of wet land, under Government Circular No. 1382-90, dated 1st October 1858. Of course, this lump-sum contribution does not exonerate the dry landholder from paying the usual wet assessment and cesses. The assessment is paid on the whole irrigable area of a survey number in his holding; small branch channels to the depth varying according to different levels, from half a foot to two feet, are excavated for conveyance of water to the fields. The cost, which will be borne either by the wet land owner or his tenant, according to their mutual agreement, would not be more than a rupee for a furlong.

25. *Question No. 30.*—The standing rules on the subject of watch and maintenance of tanks by *raiyats* are contained in the late Chief Commissioner's Notification of 24th November 1863 in the following terms:—

(*i*) To fill up gullies or other inequalities caused by rain, the treading of cattle, etc., upon the bund of tanks and channels.

(*ii*) To check the growth on bunds of the prickly pear and any similar rank and pernicious weed.

(*iii*) To clear away such underwood from the bunds of tanks as may be considered by the District Engineer to be injurious.

(*iv*) To clear out the deposits from tank sluices and from river and spring channels to such an extent as will afford a sufficient opening for the supply of water to flow to the *raiyats'* fields.

(*v*) To clear and repair the earthwork of petty and branch channels and clear away the accumulation in all channels issuing from tanks which obstruct the flow of water to the fields.

(*vi*) To keep in order the supplying channels of tanks to such extent as is sanctioned by local custom.

(*vii*) To watch the bunds of all tanks during rainy weather; to turf the parts acted on by the waves which appear leaky; to open and close the *calingulas* and generally to perform minor duties of this nature to prevent breaches and other accidents.

(*viii*) To construct ring dams at breaches, and where requisite to temporarily strengthen the bunds of tanks during the season of cultivation; and in general by that constant care and attention which residents on the spot can alone exercise to preserve the works of irrigation in which they and the Government have a common interest, from those small injuries which, if unchecked, will lead to serious loss and expenses.

(*ix*) For the village authorities to hinder the *raiyats* of their respective villages from doing anything which may tend to endanger an irrigation work, such for instance, as throwing a bund in front of the *calingula* to keep the water at a high level, making temporary cuts in the bunds of tanks or introducing pot sluices into them. The village authorities will be held responsible for any damages occasioned by their neglect of this rule.

26. These rules are similar to those laid down in Madras Revenue Board's Standing Order No. 51. They are known as "kudi maramat" or village labour. It was the non-enforcement of these rules from time to time since 1856 when, in consequence of the creation of the new Department of Public Works, the Revenue officers ceased to take active interest, that has now brought the numerous tanks to their present lamentable condition, as already explained above. The present difficulty is that the above maintenance rules cannot be enforced without causing hardship to the *raiyats*, unless in the first instance all the tanks are put in thorough order. In consequence of the continued neglect for a series of years, the cost of earthwork, which the Government now call upon *raiyats* to do, has become so heavy that the *raiyats* are unable to bear it, as the generality of the agricultural *raiyat* class which form about 40 per cent. of the population are poor and small farmers, as evident from the annexed rent rolls made out in 1878 by the Commissioners of the Astagram and Nagar divisions, showing that out of 152,513 registered landholders in the three districts of the Nagar division, 99,889, or 65 per cent. are payers of Government revenue within Rs. 10 a year; and that out of 303,243 registered landholders in the two districts of the Astagram division, 234,129, or 76 per cent. are those paying an annual assessment below the said sum of Rs. 10. As for the other three districts of the Nandidrug division, I have not the similar details; this want may be supplied thus: in one of his reports in 1878 General Pearse, the then Commissioner, who had official connection with that division, for 22 years, has stated that the average holding of the smaller cultivators does not exceed 4 to 5 acres, and that the ordinary rate of dry land assessment in his division is Rs. 1-8-0 per acre. Assuming that a poor *raiyat's* holding consists of three-fourths of dry land and one-fourth of wet, the assessment of 3 acres of dry land would be Rs. 4-8-0 at the rate named by General Pearse, and that of one acre of wet land at Rs. 4 is Rs. 4, making a total of Rs. 8-8-0; these figures confirm the rent rolls of the other five districts as to the general pauperism of Mysore agricultural *raiyats*.

While the *raiyats* thus unable to repair our tanks, the State finances on the other hand do not admit of the Government undertaking the earthwork portion of the repair in addition to stone and brick-work which they are ready to execute. Colonel Sankey had in 1866 estimated the cost of restoring 1,500 first class tanks and 4,500 second class tanks at 90 lakhs of rupees. The lapse of 31 years subsequently must necessarily have increased the deterioration of the tanks to such an extent as would require three times the outlay which Colonel Sankey estimated in 1866. From the Proceedings of 1888 Annual Dassara Meeting, it would appear that the *raiyats* express their readiness to bind themselves to keep the tanks in maintenance, if the large repairs now needed be carried out at Government cost. Owing to this long and repeated contention, the small tanks are falling into decay more and more year by year. Some final settlement of this contention and a legislative penal provision for failure to maintain tanks once thoroughly restored appear in my humble opinion very necessary. The irrigation cess of one anna imposed in 1870 for maintenance of tanks may, as proposed by the late Dewan in his Dassara speech of 1881, be also remitted not permanently, but at the close of every year on the certificate of a competent Revenue officer that *raiyats* the have performed their statutory labour satisfactorily.

27. *Question No. 31.* In the case of private tanks, the tank owner makes his own arrangements for the distribution of water to the *raiyats'* fields. When the owner is an outsider and when the lands below the tank are already in the occupancy of the villagers paying dry land assessment to Government, great trouble arises; the dry landholders combinably refuse to utilize the water at all and pay anything to the owner with the sole object of causing the owner such serious loss as would lead him to the sad necessity of relinquishing his ownership to Government. There was one sensational case from 1866 to 1873 in the Tirmakudlu Narsipur taluk of the Mysore district relative to Kaggala tank restored by one Srappadevaru, a private capitalist. The Chief Commissioner's finding that the dry landholders were, as in the case of Government tanks, bound either to utilize the water, paying wet land assessment to the tank owner, or relinquish their dry lands to him, was appealed against to the Government of India who took objection to the policy of such compulsion. On a further representation from the Chief Commissioner that the peculiar circumstances of the Province in regard to the numerousness of its tanks rendered non-interference with this long-established policy inexpedient, the Government of India submitted the question for the decision of Her Majesty's Government who, in State Secretary's Despatch No. 8 of 22nd May 1873, held that, under the explanation afforded by the Chief Commissioner, it was inadvisable to interfere with the practice in question which had long prevailed in Mysore.

In granting permission to restoration of private tanks hereafter, the relative future positions and liabilities of the tank owner and the dry landholders should be clearly defined and recorded to prevent ultimate disputes, and benefit of section 67 of the Mysore Land Revenue Code be afforded to the tank owner in respect of the recovery of his dues unjustly withheld by his tenants. This precaution will not be necessary in the case of tanks having no occupied lands below, as the tank restorer will then be the absolute owner of every bit of unoccupied land irrigable by his tank. It is also reasonable to make the dry landholders liable to pay the tank owner the lump-sum contribution for enhancement of the value of their dry lands by the irrigation, in conformity with the principle recognized in the Government Circular No. 1382—90 of October 1888 quoted in paragraph 21 of this memorandum, in respect of large projects constructed by Government.

28. *Question No. 32.* Greater encouragement to the restoration of ruined tanks by private capitalists seems very desirable. Colonel Meade's restriction on the operation of Mr. Bowring's Circular of 31st March 1863 already quoted

as regards the duration of the concession of one-fourth assessment appears from the records to have proved detrimental to Government interest. Mr. Krishnaiengar, the late Deputy Commissioner, Kolar district, who had presided over that district for a continuous period of 15 years, has made the following observations in his memorandum of the 14th September 1878:—

"The improvement of land has been checked to a great extent by the orders issued by the local Government in 1871 modifying those passed by Mr. Bowring in 1863. The extent to which the improvement of land is hindered by the order of 1871 which is now in force can be observed from the fact that between 1864 and 1871 five hundred and sixty ruined tanks were repaired by *raiyats* and others of the country wholly at their own cost, amounting in round figure to Rs. 2,40,000, adding an annual revenue of Rs. 14,000 to Rs 3,000 previously derived from the lands below them, and 870 wells were sunk; while since 1871 no more than six ruined tanks were taken up by the *raiyats* and only 97 wells sunk; and this is in my opinion undoubtedly due to the restrictions laid down in the order of 1871."

The soundness of the removal of the restriction complained of has been recognized by the late Dewan Mr. Sheshadri Iyer in his reply to the Representative Assembly in 1893 in the following terms:—

"If the motives of self-interest which will thus be enlisted in our service should fail to have the desired effect, the restoration of the most important tanks now in disuse will be thrown open to private capital and enterprise under what is already well known to you as the Chowthayi system. The system will be simplified, and the remission of one-fourth of the assessment, instead of being limited to 30 years or until the introduction of the Survey Settlement, will be made a permanent concession."

In the original circular of 1863 Mr. Bowring fixed no duration as to the one-fourth remission. It was only in the subsequent order of 1871 that his successor Colonel Meade ruled that the concession was to continue for a particular period. The Dewan has in the same reply also promised to grant even more liberal concessions in the case of tanks requiring an exceptionally heavy outlay for their repair or restoration. From the statement appended to paragraph 6 of this memorandum it will be seen that 13,625 tanks are not now yielding a single pie to Government, and it may fairly be presumed that they are now in a dilapidated condition. I do not therefore hesitate for a moment to recommend that the restoration of these 13,625 tanks may, by the publication of a proclamation, be offered to such capitalists as would undertake them on the condition of their entire exemption from payment of assessment for the first ten years, and thereafter paying permanently half the rates of wet assessment. Some such concession on a lesser scale may also be allowed in the case of many other such minor tanks as are within 100 rupees revenue and have fallen into disrepair. Before finally sanctioning the application of an outsider for restoring a tank, it is necessary that the people of the village in which the tank is situate should be asked if they are willing to undertake the work on the same condition, and their refusal be recorded to prevent future complications.

Rent Roll of the Nagar division comprising three districts of Shimoga, Kadur and Chitaldrug:—

				Rs.
(*a*)	71,409	within annual kandayam of		5
(*b*)	18,480	above 5 and within		10
(*c*)	20,243	„ 10 „ „		20
(*d*)	10,173	„ 20 „ „		30
(*e*)	6,410	„ 30 „ „		40
(*f*)	5,421	„ 40 „ „		50
(*g*)	2,749	„ 50 „ „		60
(*h*)	1,859	„ 60 „ „		70
(*i*)	1,397	„ 70 „ „		80
(*j*)	1,123	„ 80 „ „		90
(*k*)	1,395	„ 90 „ „		100
(*l*)	1,669	„ 100 „ „		200
(*m*)	351	„ 200 „ „		300
(*n*)	104	„ 300 „ „		400
(*o*)	56	„ 400 „ „		500
(*p*)	34	„ 500 „ „		600
(*q*)	9	„ 600 „ „		700
(*r*)	9	„ 700 „ „		800
(*s*)	13	„ 800 „ „		900
(*t*)	2	„ 900 „ „		1,000
(*u*)	6	„ 1,000 rupees.		

Total number 1,52,513 of Pattadars.

Rent Roll of the Astagram division comprising two districts of Mysore and Hassan:—

No.	Rates.			Number of Pattadars.
	Rs.	Rs.		
1	Below 5			175,269
2	From 5	to 10		58,860
3	„ 10	„ 20		32,738
4	„ 20	„ 30		17,428
5	„ 30	„ 40		6,063
6	„ 40	„ 50		3,742
7	„ 50	„ 60		2,728
8	„ 60	„ 70		1,488
9	„ 70	„ 80		1,056
10	„ 80	„ 90		785
11	„ 90	„ 100		1,504
12	„ 100	„ 150		667
13	„ 150	„ 200		173
14	„ 200	„ 250		93
15	„ 250	„ 300		25
16	„ 300	„ 350		13
17	„ 350	„ 400		6
18	„ 400	„ 450		3
19	„ 450	„ 500		1
20	„ 500	„ 1,000		1
			TOTAL	303,243

Moulvi Abdul Kadir.

HYDERABAD.

(8) MOULVI ABDUL KADIR, Subadar (Revenue Commissioner), Gulbargah Division.

Answers to printed questions.

A.—GENERAL.

I. The answers refer to the following districts:—

1. Warangal	Telingana.
2. Elgandal	
3. Nalgundah	
4. Mahbubnagar	
5. Lingsugur	Mahratwara.
6. Osmanabad (Naldrug)	

I was 2nd Talukdar (Assistant Collector), Assistant Commissioner, first Talukdar (Collector) and Subadar (Revenue Commissioner) in the above districts. At present I am Subadar (Revenue Commissioner) of the Gulbargah division.

II. The average rainfall in each month of the year is as follows:—

		Annual rainfall.
Warangal district	2·5	30
Elgandal „	3·0	36
Nalgunda „	2·08	24·96
Mahbubnagar „	2 5	30
Lingsugur „	1·5	18
Osmanabad (Naldrug)	2·2	27

Not only does the amount of rainfall differ considerably in different taluks, but it varies not a little from year to year, in the same taluk. Moreover, even when the number of inches does not fall short of the average, the distribution may be so irregular as to cause a partial failure of the crops.

III. (1) Sparsity of population is no obstacle here to the extension of irrigation.

(2) Insufficient supply of cattle will not be a check to the cultivation of irrigated lands.

(3) Insufficient supply of manure will not bar the extension of irrigation.

(4) There is no unsuitability of soil to irrigation in Telingana districts.

(5) Uncertainty of the supply of water does exist owing to the storage of water in tanks mainly by means of catchment basin, and this means all the tanks with very few exceptions depended on the varying rain. If independant sources of water supply, such as channels from rivers wherever practicable, be constructed to feed tanks by continuous flow, the obstacle will be diminished. In either case, of late commencement or early cessation, no remedial measure can be suggested, and *abi* or *tabi* crops will accordingly suffer only in such cases where the feeding channels cannot be secured.

(6) The chief and main obstacle to the extension of irrigation is the lack of capital for the initial expenditure on the part of Government, and of funds for the more expensive cultivation of irrigated crops on the part of the *raiyats*.

(7) There is no fear of enhanced revenue assessment in extending irrigation.

(8) No uncertainty of tenure or defects exist in the Tenancy Law in force here.

(9) No other reasons can be adduced against the extension of irrigation.

IV. Exemption from enhancement of assessment in the Telingana districts is granted for a period of 15 years. For the first fifteen years, only dry rates are charged, and for the next fifteen years double the dry rates are levied. After the lapse of thirty years wet rates are introduced. In cases of extension of irrigation by tenants to their holding at their own cost, no enhancement in the existing fixed assessment is made till the expiry of the settlement period. I do not consider the existing provisions sufficiently liberal. I suggest, as follows, different alterations and provisions for the construction of wells, tanks and channels by private individuals.

A. *Wells* 1. *Raiyats* should have the full benefit of their own improvements, the lands improved by private wells being subject to no additional assessment on that account so long as the settlement rates remain unaltered.

2. The *raiyats* should receive the most distinct assurance that the tax or lands cultivated by means of wells henceforth to be constructed by them at their own cost, will never be enhanced unless on a general revision of the settlement rates, and that, on such revision, any modification in the assessment of lands so improved will be irrespective of the increased value conferred upon them by their own holders It is also to be explained to the *raiyats* that, when the settlement rates of a district may be altered, the demands will be regulated with reference to the intrinsic quality and position of the land as compared with other land of similar natural soil and situation and not with reference to any improvement which may have been effected by the *raiyats* at their own cost.

3. If the *raiyats* instead of constructing permanent wells as mentioned above, undertake to get up *Lucha* wells, half of the wet rates under wells will be charged.

B. *Tanks* 1. The *raiyats* who construct a new tank at their own cost are to pay perpetually the assessment of so much of the land covered by its waterspread (*i.e.*, the area of the contour of the tank) and of the area of the avacut at dry rates, and no enhancement in the rates for the latter will be effected till the expiry of thirty years when settlement wet rates will be introduced.

2. Tanks in a ruined condition for upwards of ten years and which the Irrigation Department do not propose to put in repair, may be repaired by the *raiyats* at their own cost on condition of paying for the lands in ayacut double the dry rates for a period of thirty years. After the lapse of thirty years the settlement wet rates will be brought into force.

C. *Channels.* 1. The *raiyats* constructing channels at their own cost from rivers or natural pools for the purpose of irrigation, will have to pay assessment at settlement dry rates for a period of forty years, and after the lapse of forty years' settlement wet rates will be introduced.

2 Channels in a ruined state for upwards of ten years and which the Irrigation Department do not propose to put in repair, may be repaired by *raiyats* at their own cost, on condition of paying for the land under cultivation double the dry rates for a period of forty years, after which settlement wet rates will be imposed.

[*N. B.*—In cases of tanks and channels, the Irrigation Department should be consulted as to the advisability of granting or withholding the applications of *raiyats*.]

The Land Improvement Act has not yet been passed in H. H the Nizam's Dominions, and suggestion on the same cannot be offered.

VI. The extension of irrigation will under no circumstances injure the remaining cultivation by attracting the *raiyats* to the irrigated lands. No instance was brought to my knowledge of *raiyats* being attracted by the extension of irrigation by giving up their present holdings. There is a strong desire evinced by the *raiyats* for means of irrigation.

B.—CANALS OF CONTINUOUS FLOW.

VII—XI. No canals of continuous flow exist in the abovementioned districts.

C.—CANALS OF INTERMITTENT FLOW.

XII. In the Telingana districts there are small irrigation channels supplied by dams thrown across a river-bed or a jungle stream to maintain the level of water.

2. No scientific method is adopted by which the water could be distributed to the land, but the water is let out through sluices to irrigate land without any check or hindrance, causing a great waste of water.

3. *a, b, c. vide* answers to question No. 23. (3) *a, b, c,* under D—Tanks.

XIII 2. *Vide* answers to question 24 under D—Tanks 1, 2 and 3 *a, b, c.*

XIV. *Vide* answer to question 25, (1) and (2) under D—Tanks.

XV. *Vide* answer to question 29 under D—Tanks.

XVI. and (1) (2). *Vide* answer to question 27 under D—Tanks.

XVII. *Vide* answer to question 28, (1), (2), (3) under D—Tanks.

(4). No royalty is paid by the owners of the channels to Government.

XVIII. *Vide* answer to question 29 under D—Tanks.

XIX. The diminution of manure results in the reduction of produce, and so the people suffer. Too profuse, too extensive and too frequent irrigation are not in practice here. Instances of water-logging do not occur here. The presence of efflorescence diminishes the produce of the field. The limits of the extent of the damage varies from one-third to half of the average harvest. I opine that sufficient quantity of manure should be utilized to expect proper out-turn which *raiyats* cannot realize owing to their poverty. No evil has been noticed regarding the irrigation in question here. They do not drain the irrigated land at all.

XX. *Vide* answer to question 30 under D—Tanks.

XXI. No canal has been constructed by private persons.

XXII. I consider that it is advisable to encourage the construction of canals by private individuals in form of companies. Private enterprise may be advantageously secured by granting a lease for 99 years on a small royalty, and the arrears of watercess will be recovered for the company by the Revenue Department by adopting the same measures as for the recovery of Government revenue arrears.

D.—Tanks.

XXIII. (1)—In the Telingana districts almost all the tanks are fed by the drainage of catchment basin and this supply entirely depends on the rain-fall during the year, which is uncertain. Remedial measure to overcome the defects is by the construction of feeders from rivers wherever practicable.

(2) The water is distributed to the lands by means of sluices constructed in the tank bunds.

(3) The period for which the supply is ordinarily maintained in (*a*) a year of ample rainfall is 6½ months (*abi* 3 months and *tabi* 3½ months) and 10 months for paddy, sugarcane and plantain respectively, (*b*) in a year of scanty rainfall 8 months (*abi* 3½ months and *tabi* 4½ months) and 11 months for paddy, sugarcane and plantain respectively, and lastly (*c*) in a year of drought 8½ months, (*abi* 4 months and *tabi* 4½ months) and 12 months for paddy, sugarcane and plantain respectively.

(4) The area ordinarily irrigated from tank varies from 50 to 1,000 acres according to the capacity of tanks.

XXIV (1) The irrigation increases the value of the produce of land by 60·6 per cent. approximately by rendering it possible to cultivate two harvests instead of one.

(2) Irrigation increases the value by the substitution of more valuable crops by 25 per cent.

XXV. By too late commencement of the supply, the *abi* crops will suffer by about 50 per cent. and by the too early cessation, the *tabi* crops will suffer by about 50 per cent.

XXVI. The irrigation is ordinarily supplemented by irrigation from wells only in cases of tanks being dried up. It is essential to keep up the failing crop by well-water.

XXVII. (1) The approximate estimate of the increase in the total annual value of the produce per acre due to irrigation is Rs. 60 per cent.

(2) In a year of drought the increase realized is about 75 per cent.

XXVIII. (1) In the Telingana districts there is no separate rate charged for supplying water. A wet assessment is imposed which includes the cost of water-supply. This wet rate is compulsory, the average of which amounts to Rs. 10 per acre.

In Mahratwara district *raiyats* take water by paying cess which is optional, besides the land tax to be paid to Government. The rates of water cess are levied thus:—

For *abi* Rs. 1-8-0; for *tabi* Rs. 2-8-0; for *abi* and *tabi* Rs. 4-0-0; for sugarcane and plantain Rs. 6-0-0; for garden land Rs. 1-8-0; and for jawar Re. 1-0-0.

If the cultivator gets water from the owner of the tank, he has to pay the abovementioned rates and the land tax to Government.

(2) No enhanced rate is paid by the cultivator to the owner of the tank, nor is there any form of enhancement allowed.

(3) On an average, Rs. 10 per acre are paid by the holder of the land to Government in the form of enhancement of revenue both for the use of land and supply of water in the Telingana districts. In each case the rate is paid only on the area actually irrigated during the year, and as for holding or number of fields, no fractional exemption is granted for the part of a field on plea of insufficiency of water supplied, but in cases of whole numbers being left over for want of water, remission may be granted.

To bring water to the field, or to prepare the land for irrigation, no expenditure is actually incurred, but personal labour is employed. This labour falls on the cultivator, be he tenant or pattadar. I may note here that pattadars invariably till their own lands. This labour is taken into consideration at the time of assessment by deducting about one-fourth of the gross produce. In cases of tenants, the pattadars grant them the same deduction.

The silting and repairs to tanks and main channels are undertaken by Government, and all the branch channels by which the *raiyats* take water to their fields are looked after by the *raiyats* themselves. The approximate annual cost per acre irrigated is about one-tenth of the revenue assessment. The system works fairly well and no legislation, in my opinion, is required.

XXXI. In the case of tanks constructed by private persons, after the distribution of water to the ayacut, the owner, if he finds that he has an excess storage of water supplies it to the other holders of the land and charges them water cess. There is no complaint regarding the recovery of the water dues since the Government collects assessment from the *raiyats* and pays the owner of the tank the amount due to him under water-cess.

XXXII. I consider that it is advisable to encourage private individuals in the construction of tanks. This could best be done by the introduction of rules as suggested in the answer to question 4.

XXXIII. In His Highness the Nizam's Dominions no steps are taken to prevent the silting of the bed of the tank nor is the silt removed.

E.—Wells.

XXXIV. (1) The average depth of wells in Tilingana districts is 24 feet approximately.

2 (*a*) In an ordinary year some wells are supported by springs and some by percolation. The latter fail when tanks have no water, for the distribution of rain in Telingana parts, as already noted in answer to question II. A—General, is not uniform.

(*b*) All wells fed by percolation entirely fail in a year of drought.

(3) The average cost of construction of wells in Tilingana districts is about Rs. 300.

(4) The average duration of wells is about 20 years.

(5) The manner in which water is raised is by means of *mots* and water-lifts (*yatams*).

(6) The average area commanded by a well is about 2 acres for a single *mot*.

(7) The average area irrigated in any one year is about 2½ acres in a single *mot*.

XXXV. *Vide* answer to question 21 under D—Tanks.

Note.—Well water is warmer and more fertilizing than tank or canal water.

XXXVI. *Vide* answer to question 25 under D—Tanks.

XXXVII. *Vide* answer to question 27 under D—Tanks.

The rates are paid on area commanded by wells.

XXXVIII. (1) No serious difficulty is noticed in Telingana for the selection of a spot for supply of water.

(2) In some localities on account of bad soil, difficulties are met in the construction of wells; the side supporting the *mot* is built up of stones and the other three sides left as they are. The result is that unprotected soil fills up the well, blocking up the spring and percolation. The *raiyats* having no boring tools arrive at stone layers, the blasting of which is very expensive. No assistance is rendered by Government to the *raiyats* in the shape of boring tools, expert advice, etc.

XXXIX. I am not in favour of the construction of wells by Government in either private or in Government lands. The objection is, if the wells be constructed by Government, the maintenance will also rest with it, and *raiyats* will not care to look after them, as they would if their own. I am of opinion that private enterprise should be encouraged and the construction of wells be left to individuals on the distinct assurance that taxes on land cultivated by means of wells constructed by them at their own cost, will never be enhanced.

XL. In times of drought, temporary wells are commonly used in Telingana districts, and these do not enable the *raiyats* to overcome their difficulties.

To encourage the construction of temporary wells, I propose that the area irrigated by such wells should be subject to dry rates only, and no enhancement should be made.

Mr. Sohrabji Jamshedji.

(9) Mr. Sohrabji Jamshedji, First Talukdar (Collector), Bidar district.

Answers to printed questions.

A.—General.

1. These answers refer to the Bidar district, His Highness the Nizam's Dominions. Twenty years ago I was in this district as an Assistant Superintendent, Revenue Survey. Now I have been posted here as Collector, since March 1901.

2. The average rainfall of 1900-1901 was:—

June	8·8.	October	0 37.	February	1·58.
July	10 35.	November	0·	March	0·39.
August	5·22.	December	0 11.	April	3·4.
September	5·41.	January	0·8	May	0·45.
				Total	35·10

The rainfall during the monsoon of 1901-1902, (*i.e.*, from June to September) was 22·48, and the same last year was 29·16. The average good rainfall is 32 inches.

3. (1) The population during the census of 1891 was 475,387 whereas the same during the last census was 371,691. The decrease of 100,698, or 21·18 per cent. is chiefly owing to migration to better districts, and partly owing to high mortality during the last famine. The sparsity of population will retard extension of irrigation at least for three years

(2) The number of cattle used for cultivation during 1899 was 133,752. The same during 1901 was 64,521. The decrease of 69,231 is 52 per cent This decrease will tell upon irrigation for 5 years.

(3) Manure could not be had for irrigation till the increase in cattle.

(4) The soils of the Bidar, Kohir, Janwada and the Aurad talukas are suitable for paddy and garden cultivation. Those of Rajura, Udgir and Nilanga are adapted to garden crops.

(5) There will be no uncertainty under wells, but the flow supply will depend upon local rainfall. But this will not retard extension of irrigation, as failures of monsoon are not frequent.

(6) The present wet area is two per cent. of the total occupied ryotwari area. There is still margin in the capital of the cultivators for extending irrigation to about 8 per cent. of the total area.

(7) and (8) Owing to more profit in wet crops there will be no fear of enhancement of rates. The tenure is quite secure as long as fixed rates are paid.

4. For lands irrigated under works constructed or improved by private capital, Government do not charge wet rates at present nor will they enhance rates during future revision. The existing provisions are sufficiently liberal.

5. Loans under Land Improvement Act are not granted to rayats, but *takavi* for new wells and repairs of old ones should be freely granted under certain restrictions, at 6 per cent. simple interest. It will be very freely taken by the people, as they have to pay the *sahukars* 24 to 30 per cent. compound interest. Besides these high rates of interest, the rayats have to undergo much loss by the false accounts entered in the books by the *sahukars*. In case of a new well, if after digging to a certain extent no water is tapped, no interest should be charged on the *takavi*. For old wells the period of repayment should be fixed at 5 years, and for new wells or dams across *nalas*, at 10 years as maximum. The local officer, should fix the period within the maximum

6. The extension of irrigation up to 8 per cent. of the total area or even up to 20 per cent. will not injure the dry cultivation, as the times for ploughing and sowing, etc., are different for wet and dry crops. In fact, irrigation will keep the men and cattle fully employed as in the case of Telingana. There is a strong desire for extension of irrigation sources.

B.—Canals of continuous flow.

7 to 11. There are no canals of continuous flow in this district nor will they pay here.

C.—Canals of intermittent flow.

12. (1) Temporary dams thrown across small *nalas*, irrigate few fields, as Government did not construct good many of them, nor do they repair them annually. Wet crops are not charged under them. However some of these, which existed at the time of settlement, have been entered as Government channels, and fixed wet rates are charged with fixed areas. No remissions are granted under them as in the case of Telingana. These channels are fed by the streams.

(2) The water is distributed to the fields by the *raiyats themselves.*

(3) In the year of ample rainfall, these channels supply water during the monsoon and cold weather to ordinary garden crops. Sugarcane and other crops wanting irrigation till the hot weather, are not grown under such channels. In the year of scanty rainfall, the supply fails from December; in the year of drought, in August.

13. (1) If two harvests are cultivated, the value of produce of land increases by 50 per cent. as compared with single crop. But in this district, garden crops and only single paddy crop are generally grown.

14. (1) (2) By too late commencement or too early cessation of irrigation, the yield would be about one-fourth or half as compared with full irrigation. This depends upon the extent of lateness or cessation.

15. In some cases the flow is helped by wells, and specially in the case of sugarcane. The well is resorted to when the spring fails.

16. (1)-(2) This depends upon the nature of crops. As for instance, if sugarcane is grown, then the value of the produce as compared with jawari dry crop would be 20 times. In like manner, as compared with the dry jawari crop, the value of *chillies* would be 16 times, the same for wheat would be 4 times. The same relation would exist in a year of drought.

17. (1)-(3) The average rates per acre of irrigated garden crops are very nearly the same as under wells, so I shall give the figures there. The rates are paid on the whole irrigable area fixed by the Settlement Department. Sub-paragraphs 1-2-6 could not be replied to.

18-21. (1) Not applicable to this district.

22. Irrigation by private canals should be encouraged, as also by wells, by *Takavi* advances at 6 per cent. payable within 10 years. Such private improvements are not charged by Government, and they should not be charged in future.

D.—Tanks.

23. (1) Tanks are filled with catchment rain water as also from small and large streams. These streams act as feeders only till the middle of cold weather, as they are not perennial.

(2) The water is distributed through sluices and small channels into the fields by the *raiyats* there being no *neeradees* in Marathwara districts.

(3) The supply is ordinarily maintained till January in a year of ample rainfall. There are in all 22 tanks in this district but not in good order. Hence in a year of scanty rainfall they do not fill well, and in a year of drought there is water hardly sufficient for domestic puurposes.

(4) There are no large tanks in this district in good order. Having no register on tour, I cannot give the areas under each.

24-29. The same as canals with intermittent flow. *Please see answers Nos. 13-21.*

30. The tanks at present are not maintained annually. They are repaired by Government whenever they breach, or get silted up, or the bunds get worn out. As the number is too small, no legislation is required.

31. There are no private tanks in this district.

32. I do not think this will succeed in Bidar.

33. Although all tanks are liable to silt up to certain extent, I think the cost of removing the silt will be nearly the same as of constructing new ones. When the bund is repaired, the earth is taken from the bed, the big hollows are filled up by the accumulated silt, and thus the normal level is preserved for great many years. The silt is not removed by dredging. One important point deserving notice of Government is that the Irrigation Department as also the "Dustbunddars" do not pay as much attention as is necessary to the silt clearance of the feeder channels of the tanks. I have generally noticed in the Telingana districts that the Jagirdars are very attentive towards this point, with the consequence of rapidly filling up their tanks. Near Pattancheroo, I have seen lot of water in Jagir tanks, whereas the Government tanks had been almost dry, with the usual plea of scanty rainfall. It must therefore be clearly ruled that all estimates must include deepen-

ing or silt clearing of the feeder channels, by which a few inches of rainfall would guarantee sufficient storage.

Repairs to the present tanks.—I have submitted a statement of 27 tanks and 22 dams across small rivers, in the *talukas* of this district. With modifications as regards approximate cost of repairs and the net increase in revenue, I submit the following summary of the same with these notes.

Mr. Sohrabji Jamshedji.

Talukas.	No. of Sources. Tanks.	Kunias.	Dams.	Estimated cost of repairs.	Irrigable Area. Acres.	Amount.	Deduct present Revenue on costs.	Net increase in Revenue.	Percentage of increase.	Remarks.
Divani.				Rs.		Rs.	Rs.	Rs.		The estimated revenue on irrigable area has been worked out at Rs. 3-8-0 per acre for *talukas* Nos. 1, 2, 3, and 6, and at Rs. 6-8-0 for Nos. 4, 5, and 7. These average rates are now prevalent in these *talukas*.
1. Rajurah	2	...	16	47,868	2,151	7,528	2,597	4,931	10½	
2. Udgir	3	...	4	22,123	1 038	3,633	1,487	2,146	9¼	
3. Nalanga	1	...	1	8,075	261	914	300	614	7½	
4. Bidar	6	...	...	24.000	1,051	3,679	906	2,773	11⅛	
5. Kohir	3	5	...	19,000	470	3,055	459	2,596	13¼	
Total	15	5	21	1,21,062	4,971	18,809	5,749	13,060	10¾	
Sarf-i-Khas.										
6. Aurad	3	...	...	6,000	350	1,225	350	875	14½	
7. Janwada	4	..	1	1,10,000	1,550	10,075	1,550	8,525	7¼	
Total	7	...	1	1,16,000	1,900	11,300	1,900	9,400	8	
GRAND TOTAL	22	5	22	2,31,062	6,871	30,109	7,649	22,460	9⅝	

E.—Wells.

34. (1)-(7) The following statement has been prepared partly from observation and partly from statistics:—

Taluka.	Wells in Repair.	Dis-repair.	Total.	Average depth.*	Nature of supply.	Average cost of construction.
1. Rajura	552	47	599	21 ft.	From springs still Rs. 800; and partly in hard soil from percolation.	In black soil Rs. 200.
2. Udgir	1,004	512	1,516	24 „		
3. Nilanga	250	248	498	24 „		
4. Bidar	209	280	492	45 „		
5. Kohir	515	104	619	30 „		
Total Divani	2,524	1,200	3,724	27 „		

*The average depth is for a good year, but the level of water has gone down, since the last famine, by about 9 feet.

The cost of superstructure is greater in black soil.

The supply of well water in ordinary years does not fail, but in years of drought there is partial failure. Wells in the town of Bidar have saline or brackish water, but outside the town the water is good. The average duration of a *pukka* built well is said to be about 100 years. The water is raised usually by '*mots*' of two bullocks, and very seldom of 5 bullocks.

The average area attached to and commanded by a well of one "*mot*" is about 4 acres for sugar-cane, 6 for paddy, and 8 acres for other garden crops. Half of the above area is irrigated every alternate year and the other half is cultivated with dry crops. This is called '*pher palee*' in Marathi.

35. (1)-(3) Irrigation generally increases the value of the produce as follows:—

	Jawari.	Wheat	Chillies.	Tobacco.
Dry crop	5 Mds.	5 Mds.	5 Mds.	5 Mds.
Wet crop	12½ „	15 „	80 „	30 „
Increase	2½ times.	3 times.	6 times.	6 times.

If chillies are cultivated as first crop, onions or tobacco are cultivated as second crop. Thus two crops are raised the same year, and the value of both wet crops is raised by 8 times as compared with the dry chilly crop If sugarcane is cultivated instead of dry jawari, the increase would be about 20 times. The above reply is regarding the difference between a dry and a wet crop. If, in a single crop wet land, two crops are cultivated in any year, the increase in the value of produce would be about 50 per cent. The increase owing to a change of valuable crop depends on the nature of crop, as well as on the mode of cultivation. The above proportion relates to a good as well as an ordinary year. In a year of drought the dry crop would completely fail, whereas a wet crop would be half or one-fourth.

36. Figures given in answer to No. 35 per acre in a normal term of years.

37. (1)-(2) The average annual rates per acre on account of well irrigation paid by owners to Government for each *taluka* are as follows.

The cultivator does, cultivate lands of owners on the Battai system, hence no average could be worked out.

	Rajura.	Udgir.	Nilanga.	Bidar.	Kohir.	Total.
Dry rate	0-10-0	0-12-1	0-3-0	1-1-0	1- 6- 4	0-12-0
Wet rate	3- 5-0	3- 6-6	3-4-1	6-1-6	6-14- 2	4-8-0
Difference	2-11-0	2-10-5	2-7-1	5-0-6	5- 7-10	3-12-0

The water rate is not charged separately, and no remissions are granted for partial or total waste. The Government have fixed the area under each well, and increase in wet cultivation is not charged.

38. (1)-(2) No serious difficulties are often encountered in the selection of spots for well or in the construction of them. No assistance in the shape of expert advice, trial borings or the use of borings tools, has been offered by Government Even if such advice or assistance is offered, I do not think it will be generally resorted to, because the *raiyats* are very conservative in every thing.

39. I am not in favour of the construction by Government of wells in lands which are private property, because the *raiyats* would not reciprocate Government's kindness through all sorts of suspicions. The best way to increase the number of wells for irrigation would be by granting *takavi* at 6 per cent. simple interest, returnable within 5 years for repairs to old wells, and within 10 years for new wells, from the date of advance. This period should be fixed as maximum, and local officers should use discretion.

40. Temporary wells are not commonly used in this district. They are dug up in the beds of rivers or *nalas* for domestic purposes during years of drought. I do not think they will be a great success for irrigation during years of scanty rainfall in the Marathwara districts.

Summary of my proposals regarding measures against future famines.

41. (1) The *sahukar* being the first and foremost cause of the *raiyats'* impoverished condition, it must be

Mr. Sohrabji Jamshedji.

the first duty of Government to extricate him from the *sahukar's* clutches: Agricultural Banks may be tried in some districts. However I think of another scheme which I submit here. If Government were to rule that all the *sahukars* dealing with the agriculturists should be registered by the Patwaries in a book kept for this purpose, and in case of failure of payments, the *sahukar* could sue the *raiyat* in the Revenue Department (instead of the Civil Court), I think the transactions could be carried on very low percentages of interest and the *raiyat* could be less cheated. At present the general rate of compound interest is from 21 to 30 per cent. per annum. I had a talk about the scheme with the Marwaris of Rajura who said that if Government were to assist them in realising their debt through the Revenue Department, they would gladly decrease the rate of interest from two to one per cent. Even at present the Tehsildars have to decide the civils suits up to Rs. 100, and so for small transactions there will be no increase of work to the Revenue Officers. Above Rs. 100 and up to Rs. 500 the Jamabandi Officers should be empowered to decide, and above Rs. 500 the Collector should hear. Although this may increase the Revenue Officer's work to a certain extent, the great benefit derived by the *raiyats* and Government would recompense it. A trial on these lines with a special act for one district will not be, I think, in vain.

(2) *Famine funds and takavi.*—For each district 2 annas every rupee collected for land revenue should be set aside as Famine fund. Out of this amount, *takavi* should be advanced to the actual cultivators for repairing dilapidated wells or sinking new wells. *Takavi* should also be granted for buying cattle, as during the last famine thousands of cattle died. For wells, the period of repayment should be fixed at 10 years, and for cattle three years. Besides the securities of their holdings, the village officials should be asked to stand security for the supervision of the transactions. Rules should be passed, by which the local officials may be checked from over-exercising their powers. But they should be plain and practicable.

(3) *Water sources.*—Dams should be constructed permanently across rivers and *nalas*, with small tanks as reservoirs at convenient distances. The water of these reservoirs could be used for irrigating present dry lands during good seasons and for raising fodder for domestic purposes during scanty rainfall or drought. If villagers come forward to construct such dams or tanks on *takavi* advances, they should be given the first opportunity. If not, Government should construct these, and charge the *raiyats* wet rates for dry lands irrigated under these sources. No increase of rate should be made on lands irrigated by private or *takavi* capital.

(4) *Railway Feeder.*—A Light Railway (proposals separately submitted to Government) is very necessary for fodder and grain during famine and for enriching the *raiyats* during good seasons.

(5) *Roads.*—A main road from Ekely to Bidar, Udgir, Rajura and Nander is very necessary for the same reasons as those ascribed to Railway. This will be about 124 miles and cost about Rs. 1,000 per mile. Fair-weather roads from Rajura to Nilanga and from Udgir to Mallegaon and Latur would open the country to all the important markets. This sort of road could be constructed at about Rs. 300 per mile, and the distance would be about 80 miles.

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(10) RAI MURLIDHAR, Subadar (Revenue Commissioner); Warangal Division.

Answers to printed Questions.

A.—GENERAL.

Rai Murlidhar.

1. Answers below refer to the Warangal district, which is one of the districts of my division.

2. Monthly average rainfall statement is appended, *vide* Appendix A.

3. Yes.

(1) In Pakhal *taluka* the population is too scarce, and the natural vegetable growth so abundant that the country is very unhealthy for almost 8 months.

The people therefore being not inclined much to occupy the lands there, the means of irrigation have suffered. A greater portion of it being reserved for *games, preserves, and forests.* The evil cannot be remedied at present.

(2) Continuous scarcity of rainfall for the last four or five years and consequent scarcity of fodder has somewhat reduced the number of cattle; but a few years' good supply of rain would restore the former condition. No direct Government help is needed.

(3) Supply is not scarce, but the cultivators are accustomed only to the use of sheep and cattle dung manure, which alone of course is not sufficient, and they supply the deficiency by the use of leaves of trees. Gradual increase of cultivation is diminishing the natural vegetable growth of the country and the time is not far off, when the supply of vegetable manure also would fall short. It is therefore necessary that the people be instructed in the preparation and use of other manures by opening some experimental fields in suitable places.

(4) There is very little of this sort of soil in this district.

(5) Not generally.

(6) Generally it is not the want of means, but idleness and a want of the knowledge of an improved sort of cultivation, which is a bar to more expensive cultivation of irrigated crops. The wet lands are more than sufficient for the wants of the existing agricultural population. The necessity therefore does not compel them to put forth more energy in the works, or to have recourse to more expensive but more paying sort of irrigated crops.

(7) None.

(8) No.

(9) In this district the whole country can be brough under wet cultivation, as the means of irrigation chiefly tanks and kuntas, are numerous. There is scarcely a place where any means of irrigation could not be availed of and if it be wanting there, the reason is that since several generations, or, say, centuries the population went on diminishing and the means of irrigation falling out of use, a greater number of them are out of repairs and lie in thick forests. It would require a long period before the Government can repair and improve and the population sufficiently increase, to utilise all these resources.

The agricultural classes are generally peasants of small means and the capitalists have not the knowledge or experience to risk their money in such undertakings, and the Government unaided by the capitalists has not the resources sufficient to import the agricultural classes from other overpopulated parts of India, and repair all the means of irrigation in a few years.

The Government offered very favourable terms for the lease of depopulated villages and the means of irrigation, but could not create a keen interest for the leases; and the few who took such leases failed to secure the desired end, as they generally did not import outsiders nor induce non-agricultural people to their lands, but, being able to offer easier terms to the existing cultivators, indirectly diminished the existing revenue in proportion.

The whole district being surveyed and settled and the country opened up by railways, it only requires now a greater attention of the Government towards the means of irrigation and the country would soon improve in the course of nature.

4. In Madhra *taluka* which is recognized as Mahratwara, a perpetual remission is granted, and the Government is entitled to only the dry land assessment.

In other *talukas*, being Telingana where the cost of constructing a well is cheap, dry rates are recovered only for fifteen years, and double the amount for the next fifteen years, full rates being charged after thirty years.

For repairs and construction of new means of irrigation leases are granted for a sufficient number of years to pay them off their costs with due interest, or if they want cash, the revenue under it is set apart and paid to them till their debt is cleared with interest up to date. The terms are quite liberal and are being availed of by the people, the only hitch being delay in the preparation of plans and estimates thereof.

5. There is no such act here, and the terms offered, as detailed in the fourth answer, are quite enough practically.

6. Not yet practically, unless easier terms are offered as illustrated in reply to the third question in answer to the other reason. The wet cultivation is very paying and so there is a strong desire for its increase all over Telingana.

B.—Canals of continuous flow.

7 to 11. There is no canal of continuous flow in the district.

C.—Canals of intermittent flow.

12. (1) and (2). There are small irrigation channels which are supplied by temporary dams thrown across a river bed by the cultivators themselves, and they distribute the water by small channels to their fields.

(3) (*b*) The water is usually supplied up to the end of the winter season.

(*a*) But if the rainfall is ample, the whole year.

(*c*) No supply.

Replies to questions 13, 14, 16, 24, 25, 27, 35, 36, may be had from the Survey and Settlement Department, they having made such estimates of produce; statements might be found in their office or reports. Briefly their answers may be inferred from the following table:—

	Rs.	A.	P.
Produce in an acre of dry crop—415 seers, worth	15	8	0
Produce in single wet paddy crop —1,250 seers, worth . . .	59	8	0
Produce in double wet paddy crop —1,875 seers, worth . . .	75	0	0
Produce in valuable crop as sugarcane, worth	800	0	0

Vide appendices B, C, D, showing the cost and produce as shown in the Survey reports of two *talukas* of this district.

15. Yes in some places. It is essential in a year of scanty rainfall or under smaller tanks wherein the tank water is not sufficient for supply to the end of the *tabi* crops.

17. (1) (2) (3) is rupees eight per acre for the land as well as water, unless the land or water supply is not Government property; in that case, Rs. 2½ for *tabi* and Rs. 1½ for *abi* is generally charged per beega, *i.e.*, ⅝ of an acre, as water-cess.

(4) There are no separate owners of canals in Government villages and in Jagirs no royalty is charged by the Government.

Land assessment or water cess is paid only on the area irrigated during the year, unless there be some lease, in which case its terms are adhered to.

18. The Government is the land-lord. The tenant cleans the channel to his field, prepares the land for irrigation by his own manual labor, and he is recouped by the yield of the year.

19. It is the big canals of continuous flow which deteriorate the soil under it. This district is supplied by water from tanks or petty channels from the river beds. As this water stagnates in the tanks or is filtered in the sand of the river beds, and does not affect the land irrigated thereby, there is no such complaint.

The country being not thickly populated, the vegetable manure is plenty, and so no effect is felt in the irrigated lands from the want of manure. *Rai Murlidhar.*

No draining of lands is required as only rice are sown in such lands, which is suited to such ever moist lands.

20. Repairs and silt clearance of tanks and channels are in some places leased out to Zemindars or other capitalists, who get ten per cent of the revenue under it. Where it is not so leased, the Irrigation Department manages it.

21. No such canals are here constructed on a grand scale. Only small channels have been constructed by the lease holders and no complaints have risen.

22. There are no big river passes through this district, and so only petty channels can be constructed by private persons and for that sufficient inducement exists by leases.

D.—Tanks.

23. Generally,—

(1) The tanks are supplied with water from the *nallas*, and in some places there is a series of tanks all being supplied from the same source one after the other.

(2) The water is distributed to the fields through cannels by the Niradees under the supervision of the village patels and patwarees.

(3) In kuntas and small tanks, water lasts through the rainy season for the *abi* crops, but in bigger tanks—

(*a*) the whole year;

(*b*) to the end of winter;

(*c*) to the end of the rains.

(4) Under kuntas less than fifty acres, under average tanks one or two hundred acres, under the large tanks from five hundred to two thousand acres and even more.

26. Reply given in answer to 15.

28 and 24. Answers given in reply to 17 and 18.

30, 31, 32. As stated in reply to 20, 21, 22.

33. Yes, average per year is not calculated. Out-lets are opened to scour off the silt.

E.—Wells.

34. The district may be divided into two tracts, the Telingana and Mahratwara, only Madhra taluka being counted in the latter.

(1) Water stands at the depth of seven yards.

(2) From percolation.

(*a*) Supply never fails.

(*b*) Fails in the hot season.

(3) A *kutcha* well costs but Rs. 30 or 40, but a *pucca* one costs from Rs. 200 to 300.

(4) Average duration of *kutcha* well is but three years, and then it requires a re-construction of *futta* and partially re-digging. *Pucca* well lasts several generations with petty repairs.

(5) The water is raised by *mot* worked by bullocks.

(6) Average area is two acres per *mot* generally, there being two *mots* to a well.

(7) As above.

37. Three-quarters of what is charged under the canals or tanks.

38. No.

39. No, the Government would with difficulty manage such petty works scattered over wide areas. The best course is to advance loans for the purpose where wanted and on due security or to grant leases on easy terms.

40. In years of drought or scanty rainfall, temporary wells are used, and they should be encouraged by granting partial remissions, as I did this year, and where the supply was insufficient for the standing crops, by ordering a remission up to half the assessment; and the Government remitted the whole in years of drought charging only dry rates.

Rai Murlidhar.

A.—Statement of average monthly rainfall.

District.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.
1	2	3	4	5	6	7	8	9	10	11	12	13
	In. Cents.	In. Cents.	In. Cents.	In. Cents.	In. Cents.							
Warangal . .	7 31	6 39	8 69	8 91	1 55	...	...	...	...	...	...	...

B.—Statement of cost and produce in an acre of wet crops.

District.	Maximum produce of paddy in an acre in favourable seasons.	Maximum produce in an acre as per average of the cultivators.	Average of columns 2 and 3.	Value at Rs. 20-8 per candy.	Deductions owing to unfavourable results of the harvest.	Net income.	Deductions of the cost of cultivation.	Deductions for Palcola at 10 per cent	Total deductions of columns 8 and 9.	Net value.	Half of net value.
1	2	3	4	5	6	7	8	9	10	11	12
	Seers.	Seers.	Seers.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Warangal .	2,012	1,600	1,806	59 13 0	9 15 6	49 13 6	12 10 0	3 11 6	16 5 6	33 8 0	16 12 0

C.—Statement of average produce in an acre of wet crops of dofasl, i.e., ali and tabi.

Talukas.	Produce in an acre of single fasl (harvest).								Produce in an acre of dofasl (harvest).									
	Under tanks.		Under wells.		Under rentas.		Under canals.		Under tanks.		Under wells.		Under canals.		Ali under tanks and tabi under tanks and wells.		Ali under tanks and tabi under wells.	
	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.	Maximum in seers.	Average in seers.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Kammamet and Mahboobabad	1,710	1,093½	720	720	1,112½	678½	...	...	1,680	1,100	900	664	...	...	850	538½	600	560

D.—Statement of cost and produce in an acre of dry crops.

District.	Maximum produce of jowari in an acre in favourable seasons.	Maximum produce in an acre as per statement of the cultivators.	Average of columns 2 and 3).	Value at Rs. 23 per candy.	Deductions owing to unfavourable results of the harvest.	Net income.	Deductions of the cost of cultivation.	Deductions for Palcola at 10 p. c.	Total deductions of columns 8 and 9.	Net value.	Half of net value.
1	2	3	4	5	6	7	8	9	10	11	12
	Seers.	Seers.	Seers.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Warangal .	560	320	445	15 8 0	2 9 0	12 15 0	6 4 0	0 10 7	6 14 7	6 0 5	3 0 2

(11) Moulvi Aga Shaik Mohamed, First Talukdar (Collector) of the Nalgunda district.

Answers to printed questions.

A.—General.

Moulvi Aga Shaik Mohamed.

My experience of irrigation works has been gained principally in the Nalgunda district, of which district I have had charge for nearly nine years, so my replies may be considered as relating solely to the Nalgunda district.

2. Statement attached marked A.

(1) The district is fairly populated, the population per square mile for the district being 438 on the cultivated area.

(2) The number of cattle in the district per square mile amounts to 526 on the cultivated area. It is a fact that, owing to the drought prevailing in the district for the past five years, cattle in the district have died off in numbers. Yet, however, in my opinion the cattle at present in the district are quite sufficient for irrigation purposes.

(3) In as much as manure depends more on the population and the cattle of the district, and when neither of them are wanting it follows that manure must be ample.

(4) With the exception of that portion of the district bordering on the banks of the Krishna, and small area of very inferior black cotton soil situated all over the district, the soil everywhere else is quite suitable for irrigation purposes.

(5) I should like to mention, before answering this question, that we have three sources of irrigation *viz.* :—

(1) Wells, (2) Tanks, and (3) Irrigation by channels from river.

As regards the supply of water from wells, we are, to a very great extent, certain, as it depends upon the clearing and deepening of them. There are nearly 12,466 wells in the district in good order.

With respect to tanks, we have to rely totally on rain, but provided tanks are once full, we can easily estimate the area of irrigation that it is possible to carry on under them. It is desirable to connect our large tanks with rivers, in order to render their filling more certain; and with this object in view, I have urgently recommended restoration of the Upper and Lower Pangal channels. Irrigation is affected by a too early commencement of rain, inasmuch as it is a sign of a bad season to follow, but an early cessation may not be disastrous to the crops if at the outset good rain has fallen and tanks have filled. The only questions then remaining are those of evaporation and absorption.

(6) There is very little doubt that lack of capital in the district is an obstacle to the initial expenditure of funds for the more expensive cultivation of irrigation crops, or to the extension of irrigation works.

It may be mentioned in this connection that Mr. Dunlop's new scheme has encouraged capitalists in the district to undertake works of this nature, but not to any appreciable extent.

(7) There is no fear, as far as I am aware, of enhanced rent or revenue assessment.

(8) There is every certainty of tenure.

(4) I am not aware of any other reason.

Q. 4.—The revenue accruing from the irrigable ayacut under a work when compared with the capital expended upon restoring it, together with 5 per cent. per annum simple interest, determines the period of time during which no enhancement in assessment is made, and this constitutes what is known as Mr. Dunlop's new scheme, the revenue is remitted to the capitalist till such time as the amount of money expended from private capital, together with interest at 5 per cent. per annum, is fully paid up.

In accordance with the dast-bund system as much as 10 per cent. of the revenue realized under the tank or channel is remitted to the capitalist, in return for which he is responsible to Government for the proper upkeep of the work.

Leases extending over a period of 30 years are also in force in the district, under which system all the enhanced revenue is remitted to the capitalist for a fixed number of years, previously agreed upon.

I think the provisions are very liberal in the case of tanks and channels, but I believe we ought to make our rules for new wells in dry lands and wells dug under tanks still more liberal, as all likely places have been already taken advantage of by those who have formerly dug wells, the sites now remaining are generally on elevated ground and consequently wells that will have to be dug will cost more, and I think, therefore, that we ought to allow new wells to be dug on the 30 years dry land lease, instead of, as at present, 15 years dry and 15 years double dry rates.

I would further suggest that, for wells excavated in lands under tanks, the rules in force may be relaxed so as to be made more liberal, *viz.*, remissions be given to the diggers of new wells just as they are given to the *raiyats* having no wells, in case there is no water stored in the tank, and only dry land rates should be imposed upon the ayacut irrigated by such wells.

Q. 5.—No loans under the Land Improvement Act are in existence in the district, and when it is considered that the cultivators are still quite backward, I do not think it is time to introduce such an act at present.

Q. 6.—Not at all, for I have found that the people of this district would rather die, than leave their native villages.

B.—Canals of continuous flow.

So far as I know, we have no canals of continuous flow in the district, and I am unable therefore to express an opinion on this subject.

C.—Canals of intermittent flow

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Q. 12.—(1) As a general rule, masonry dams or anicut are thrown across a river sufficiently high up to be able to command the tank or series of tanks, it is proposed to supply with river water. A channel leading from the anicut supplies the tanks which often are situated in different watersheds. The channel along its length is at suitable intervals, supplied with sluices for irrigating land along its course, and is thus also made to serve as a direct irrigating work in itself. Further, there are channels aligned from rivers where there is anicut in existence and are made useful in irrigating land direct without leading to any tank. These channels are for direct irrigation only.

Supply channels from rivers fill the tanks for which they are designed. Water thus stored is made available for watering lands within the ayacut of the tank. The tanks receive their own supply from their respective drainage area which in a year of ample rainfall is more than sufficient. The supply channel is a certain aid in the case of a bad season.

(3) (*a*) In a year of ample rainfall, a supply for eight months can ordinarily be maintained.

(*b*) Not longer than four months.

(*c*) No irrigation of consequence can be relied upon.

Q. 13.—(1) About 50 per cent.

(2) If dry lands be converted into garden lands and sown with chillies, brinjals, onions, tobacco, and different kinds of green food, and water supplied all the year round, the value will be increased by about 1,000 per cent.; and if dry cultivation is converted into rice lands, the value will be increased by about 1,500 per cent. for double crop *abi* and *tabi* mixed in the whole of the year. The produce from dry lands in this district chiefly consists of jawari (yellow sort), kajra and castor seed. These are below the marketable value of rice, which is a produce of wet land. Garden produce also has an enhanced market value over that derived from dry land cultivation.

(3) (*a*) In a year of ample rainfall, the full area is generally cultivated if the field is good.

(*b*) But in a year of scanty rainfall a less area is capable of irrigation and the revenue is accordingly reduced. I should say that almost all the wells in the district have a small kunta commanding the ground under the well, and if the season is a good one, it is easy to understand that much help is derived from the kunta, and the cost of labor in working the well is saved, but even when the kunta is dry, the percolation from its bed feeds the well, and hence the existence of the kunta is most beneficial.

(*c*) In a year of drought, the *raiyats* might, with greatest labour, cultivate small patches of ground assisted by wells, but this is hardly worth mentioning.

Q. 14.—(1) By too late commencement, the *abi* or rainy weather crop is lost.

(2) By too early cessation, the *tabi* or hot weather crop is lost.

(3) Whether the rains are early or late, the assessment on land for a single crop remains the same; in either case one crop is lost, which means a loss of 50 per cent.

Q. 15.—Irrigation is ordinarily supplemented by irrigation from wells given to the same land, and how far this is essential depends upon the number of times the tank or kunta is filled. If the capacity of the tank is great, the fact of its filling once is sufficient to serve its *ayacut* and assistance from wells may be dispensed with, but in the case of a small kunta the fact of its filling once or even twice, is not in itself sufficient, and wells are called into requisition. It may be added that there are instances where the *raiyats*, by digging into the sand of the river, manage to get at the underflow of the river, which they divert to their fields; but this mode is not only laborious and expensive but the results attained are also of no significance.

Q. 16.—No records kept.

Q. 17.—There are no channels owned by private individuals in the district.

Q. 18.—If the expenditure necessary to bring water into the field is only trifling, then it is incurred by the *raiyats*,

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but if the expense is beyond the power of the *raiyats*, then Government frames an estimate and incurs the necessary expenditure. All expenditure necessary to prepare the land is borne by the *raiyat*. Taking the landlord to be Government, then the security is the assessment that will be realized on the future crops.

Q. 19.—No instances have come to my knowledge of land having deteriorated from "too profuse," "too extensive," or "too frequent" irrigation, but I have noticed in parts of the district some salt efflorescence, but I have had opportunities of knowing that the cultivators themselves know how to apply the remedy. By manuring it and ploughing it up well and standing cattle on it, they succeed in removing the evil. There is no fear of water logging in as much as the district naturally is well drained.

Q. 20.—Maintenance (repairs, silt clearance and the like) is carried on by Government principally on large works on which an expenditure has been incurred by Government on its restoration, but in the case of minor channels these are leased on the *dustband* system to private individuals who are responsible to Government for their efficiency.

In the case of *dustband* maintenance, the maximum cost to Government per acre amounts to ten per cent. In the former case, where the work is maintained by Government, an establishment is appointed to look after the needs of the work; in each case the cost does not generally amount to more than five per cent of the annual revenue under the tank. The system so far, I have found to work fairly well.

Q. 21.—No.

Q. 22.—Certainly, if private persons are forthcoming, by all means allow them to construct new channels under the provisions of Mr. Dunlop's new scheme, but not otherwise, for, having regard to backwardness of the *raiyats*, an intermediary is not desirable.

D.—Tanks.

Q. 23.—(1) Tanks, not considering any supply they may receive of river water, are dependent on the rain water discharged over their catchment basins. The influx of water is again to be calculated from the nature of ground of which the catchment basin consists. Where the tank happens to be situated in close proximity to hills, the gathering of course is rapid and the tank fills early in the monsoon, but where the soil composing its catchment is porous and the lie of the country is flat, particularly if there are several tanks situated above it to intercept the drainage, such a tank, generally a large one, and with a great area of ayacut under it, takes much longer time to be filled, and is seriously affected by an early cessation of rainfall; such tanks as the latter require a supply channel from a river.

We have large tanks as for instance, Pangal and Shalli Gowrarum, etc., which formerly had supply channels from the Moosi river working to them but from frequent quarrels amongst the Zemindars of early times, these systems were allowed to fall into disrepair. We have now taken them in hand, and I have no doubt that our able Chief Engineer for Irrigation will soon see them restored.

(2) Water from tanks is distributed to the ayacut under them, by field channels leading from sluices built into the tank bund, having their silts fixed at suitable elevations, so as to command the country to be irrigated and thus fully utilize all the water stored in the tank. Ordinarily the field channels from sluices are cut by the *raiyats* themselves, but when, from the nature of the case, much expense is involved, Government bears the cost.

(3) (*a*) Twelve months or all round the year.

(*b*) Four months and even more.

(*c*) Four months because if the supply cannot be maintained for four months the rice crops will wither up.

(4) It is not possible to define the area ordinarily irrigated under a tank, even approximately, as they vary greatly in extent, but the minimum area of ayacut may be defined at 50 acres and the maximum at 1,935 acres in the district.

Q. 24.—1. 50 per cent.

2. 50 per cent, if garden is turned into rice land; if dry land is turned into rice cultivation, value of the produce is increased by nearly 12 times.

(3) (*a*) The Government cannot be said to benefit from the increase in the yield of any field as the rate of assessment per acre is fixed, which rate cannot be raised except by the Settlement Department; however the yield may be increased by about 25 per cent. in a good year, by special attention to the field itself, such as weeding it thoroughly and enhancing the fertility of the soil.

(*b*) In a year of scanty rainfall, the area under cultivation will be reduced and the yield will be proportionately less, but the value of the produce is raised.

(*c*) In the case of a tank which has a supply of river water to it, although the season locally may be one of drought, still on a fresh coming down the river, the tank will receive a supply of water and be enabled to irrigate some portion at least of the ayacut under it but if the tank is only fed with rain water, it will not be able to cultivate for want of water and there will be no yield whatever.

Q. 25.—(*a*) If I understand "value of Irrigation" to rightly mean the assessment realized from the irrigated land, then my reply is—

(1) 50 per cent.

(2) 50 per cent. provided the early rains have been favourable; otherwise no irrigation whatever is possible.

Q. 26.—The irrigation under tanks is, I am sorry to say, not generally supplemented by wells. Were this the case, then there would be no famine, and crops would not dry as they do now for want of wells in bad years, but wells constructed under tanks require to have a masonry casing, as the land is so situated with water that the four sides of the well are continually falling in. This also requires maintenance, but I am strongly in favour of wells in such situations, even if Government has to bear the first cost.

From the period of my experience in the Revenue, Settlement and Public Works Department, I am of opinion that the construction of wells under tanks is of as much necessity as is the construction of calingulas, channels, and the repairs to breaches, which the Government has considered to be beneficial and important. Should there be wells for the lands under tanks, it would be of very much use. What are eyes to the living animals, so are the wells under tanks for the lands under them. The cultivators are but blind in the absence of wells for lands under cultivation especially in the early *fasl*. After mature deliberation I have arrived at this calculation that on an average Rs. 35 will be sufficient for the digging of wells for each biga in the Nalgunda district, and casing one side of the well with laminated stone will cost another Rs. 25, so that the total average cost cannot be more than Rs. 60. The *raiyats* are unable to undertake this work and the Government by doing so will assist the *raiyats* to a considerable extent, besides increasing the revenue. I have enquired into the rates and cost very carefully, and have also made enquiries regarding the capacity of wells required to supply water in years of drought for a biga, and have found that a well should at least be six yards square, and on an average ten yards deep. Such wells of two *mots* can irrigate about four bigas of land in bad seasons. More *mots* too may be used, but in seasons of drought, water cannot be got for more than two *mots*. It is necessary for the water surface of a well to be 36 square yards to enable it to irrigate four bigas of land. The digging of such wells will cost Rs. 135, besides the amount of about Rs. 100 for casing one side of it with laminated stone. Considering that each biga of land under tank is assessed at the annual average rate of Rs. 15, I am sure that the cost of new wells can be recouped in five bad seasons. Moreover, the *raiyats* also will not be backward to pay an extra rupee or two for each biga on account of this assistance, nor will there be a want felt for animals. And waddars having domiciled themselves in the district are obtainable, and can also be procured from the bordering British territory. The few benefits derived from this system are as follows:—

(1) The entire abolition of the system of giving yearly remissions.

(2) And since water can be had all the year round, turmeric, plantains and sugarcane can also be produced besides guarding against famine.

(3) Men and animals will also be profited, and thousands of people will be supported by the construction of these wells.

(4) Since it will be necessary that there should be shade of trees for *mots*, this system will also

go to encourage the cultivators to plant trees. Further, the trees will attract rain.

(5) The lands under wells are more productive. This is not only due to the properties of well water, but also to the surroundings as the *raiyat* has always his hut on the spot and bullocks stalled which helps to the manure being preserved and obtained in the vicinity, instead of being carted from a distance. The *sahukars* seeing the *raiyat* in possession of a property will willingly advance money, thus bettering the condition of the *raiyats*.

Q. 27.—We have no record to show the actual result, as we have no statement in hand at present to show the area actually irrigated by tanks above, but I would not be far out, if I were to state that the approximate estimate of the increase of the total amount of produce for last year is H. S. Rs. 28 per acre, or Rs. 21 per biga, both for cultivated lands and lands lying waste, owing to the scarcity of water.

(1) No records kept.

(2) Do. Do.

Q. 28.—After taking into consideration, the nature of the soil and the water supplied, the rice lands are assessed. There are no separate water rates. Almost all our tanks and lands belong to Government. Hence—

(1) Cannot be answered.

(2) Do. Do.

(3) Do. Do.

But the rates paid to Government are on the area actually cultivated.

Q. 29.—Exactly the same as the reply to question No. 18.

Q. 30.—Same as No. 20.

Q. 31.—There are hardly any tanks taken up by private enterprise; in case a tank is constructed, the owner must naturally keep in his water supply for himself and should there be a surplus, then, for the water supplied, he gets his *dastband* from Government, at the rate of Rs. 1½ per biga for *rabi* and Rs. 2½ for *tabi*, and the *raiyat* is charged full rice rate. No trouble has arisen and, therefore, I do not think that any aid from Government is necessary.

Q. 32.—Of course, I consider it very advisable to encourage the repair of old breached tanks, either on Mr. Dunlop's new scheme or the cash payment system.

Q. 33.—I have not experienced any detriment to tanks silting, but on the contrary I have always noticed that the accumulation of silt has improved the soil of the beds of tanks, in as much as we have less fertile soil in the district, so the accumulation of silt benefits rather than deteriorates it. No correct statistics are available as regards the yearly accumulation of silt, because the dates of the construction and the breaching of the tanks are not known. No doubt, the Irrigation Department can always supply this information for any tank, by taking the difference of levels in the bed of the tank, and that, behind the bund or toe. But I cannot be far out, if I were to estimate the accumulation of silt from 6" to 3' yearly, and this depends on the superiority or the inferiority of the soil in the bed of the tank, and its drainage area. The richer the soil the greater the accumulation of silt. As silt is not accumulated to any great extent, it is not usual to remove it. I have not come across any tank which has ultimately been silted up, and in a case like that, the only thing to do is to raise the bund by digging near it in the bed or behind, just as the case may be. The beds of tanks are generally dug as it is easily worked, and besides by so doing, the tank is deepened and can store more water.

Q. 34.—The beds of the Krishna and the Moosi rivers being rocky, are not suited for wells, so also it is the same in the proximity of hills. Otherwise, generally in the plains of the district the ground is red soil, the depth being from 1 to 2 yards, after which moorum is found to an extent of about 6 to 8 yards. Then soft stone is met with, which can be worked with iron implements, so that blasting is not necessary.

(1) The average depth of permanent wells is not more than 10 yards.

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(2) The nature of the supply is generally from springs, but in a small portion of the district, near the Aler railway station, the wells are sunk in sandy soil, therefore water is obtained by percolation. As far as I know, water never fails in such places where digging is continued.

(3) The average cost of constructing a well is Rs. 235, or about Government Rs. 200. But the nearer we get to the Krishna river, or the hills of the Dewarkondah *taluka*, the cost of digging wells is increased from Rs. 135 to Rs. 180. But as the ground is harder, lesser casing is required, and hence the cost in both the instances is nearly the same.

(4) Wells thus constructed remain in very good order, for at least twenty years and after that time, even the cost of repairing is not much and is always gladly borne by the cultivators.

(5) The water is lifted by means of the *mot* system drawn by a pair of bullocks and occasionally relieved by a spare pair.

(6) The average area under a well of two *mots* is about 4 bigas, but it must be remembered that this area entirely depends on the extent of the well, the number of *mots*, its spring and the depth. I have seen a well at the village of Kopel with 14 *mots* irrigating nearly 21 acres of land. Such wells are scarce, but the majority of them are of 1, 2, 3 and 4 *mots*.

(7) The area irrigated by a well of one *mot* in a good season is as much as three bigas, but in years of drought the area under one *mot* is generally less than two bigas.

[NOTE.—A biga is equal to 3,600 sq. yards or nearly ⅞ of an acre.]

Q. 35.—(1) 50 per cent.

(2) If wells are dug and rice cultivation be carried on instead of dry, then the value of the produce increases from 80 seers of bajra to a kandy and half of rice, or 14 times.

Q. 36.—Owing to the absence of records, this cannot be answered.

Q. 37.—Wells belong either to Government or to cultivators: in the former case, the full rice rates are levied, and in the latter, only dry rates are fixed. These rates are calculated on the number of *mots* to a well. The maximum area for each *mot* is fixed at about two bigas, but if the cultivated area exceeds, then the actual area cultivated is assessed.

Q. 38.—No serious difficulties have been experienced—

(1) In the selection of a spot where a supply is available.

(2) As also in the construction thereof.

No help is needed professionally, as trial pits costing H. S. Rs. 10 at once show, whether a well can be successfully sunk or not; we have a complete set of boring tools in the district. As the people are used to their own old method of trial pits, they understand it better than the process of boring; besides, the cost and carriage as also the working of these tools come to as much as the cost for the trial pits, so these implements are unnecessary.

Q. 39.—As we have thousands of acres of Government land in which wells could be successfully sunk, there is no reason why private properties should be encouraged.

Q. 40.—Temporary wells are sometimes used in the district, in the bed of tanks dried up, rivers and *nalas*. The protection against drought depends to a certain extent upon the area of the bed of the tank, as also the superiority of the soil, and as water is generally procurable, they are in a way a safeguard against drought

I am not for the encouragement of temporary wells, as is now in vogue here, *i. e.*, in the beds of tanks, etc., since they cannot be of any permanent advantage, but it would be more beneficial, should they be sunk in other localities and under tanks where they could be constantly used, the cost being nearly the same.

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RAIN REGISTER FOR 10 YEARS.

Showing the rain fall for each month.

Year.	Amardad.		Shahrewar.		Mehir.		Aban.		Azur		Dai.		Bahman.		Isfandar.		Farwardi.		Ardibehisht.		Khurdad.		Teer.		Total.	
	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.	Inches.	Cents.
1301 F. .	1	71	2	27	4	9	2	89	1	20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	17
1302 F. .	5	75	3	14	11	19	11	26	9	13	...	...	0	4	1	1	0	33	2	44	...	...	...	...	44	30
1303 F. .	6	17	7	42	12	32	2	27	2	17	3	13	...	...	...	...	...	...	...	...	...	...	0	23	34	25
1304 F. .	2	98	4	76	9	22	4	60	5	41	1	63	...	...	...	...	0	24	0	83	0	75	0	75	31	15
1305 F. .	4	16	8	91	11	12	6	90	5	59	...	...	...	...	...	...	...	...	0	19	0	6	0	44	37	31
1306 F. .	2	39	2	91	3	75	3	59	...	...	1	65	...	...	...	...	0	1	...	...	...	...	...	...	14	31
1307 F. .	2	73	3	37	8	34	3	18	2	18	0	14	...	...	...	...	0	21	...	...	1	24	0	53	21	95
1308 F. .	3	94	7	97	4	11	4	37	2	10	1	63	...	...	...	...	...	...	...	...	2	20	1	31	27	66
1309 F. .	3	5	1	60	3	83	2	52	0	5	...	...	...	...	...	...	...	...	...	...	0	33	0	67	12	58
1310 F. .	7	33	5	4	2	78	8	61	1	23	...	10	...	...	0	50	1	69	...	.	1	26	1	11	29	73
Average .	4	7	4	71	7	7	5	2	2	90	0	83	0	..	0	5	0	25	0	34	0	58	0	50	23	54

SHAIK MOHAMED,
First Talukdar, Nalgundah district.

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(12) Mr. Burzoji Jamshedji, First Talukdar (Collector) of the Indur district.

Answers to printed questions.

A.—General.

Mr. Burzoji Jamshedji.

1. The answers below refer to the district of Indur, His Highness the Nizam's Dominions. First, as a Settlement Officer for eight years, and subsequently as Talukdar of the district for four years. I have had an intimate knowledge of this district.

2. During the last ten years, the average rainfall in each month of the year has been as follows:—

Name of month.		Inches.	Cents.
Teer,	(May—June)	3	56
Amardad,	(June—July)	6	72
Shahrewar,	(July—August)	11	50
Mehir,	(August—September)	11	84
Aban,	(September—October)	7	5
Azur,	(October—November)	1	55
Dai,	(November—December)	...	40
Bahman,	(December—January)	...	4
Isfandar,	(January—February)	...	11
Farwardi,	(February—March)	...	70
Ardibehisht,	(March—April)	...	61
Khurdad,	(April—May)	...	66
	Total	44	74

3. (1) Taking into consideration the average number of inhabitants which is 131 per square mile, and 53 the average number of agriculturists, sparsity of population cannot be said to be an obstacle to any great extent in the extension of irrigation in this district.

(2) In the same way, horned cattle are sufficient in number to encourage extension of irrigation, being 90 agricultural cattle per square mile.

(3) Ninety per square mile being agricultural cattle, and 60 per square mile being non-agricultural cattle, besides sheep and goats, yet an insufficiency of manure supply is felt in this district:—

(*a*) Besides the cattle manure, the cultivators manure the soil with the leaves and small branches of the teak, 'chanangi,' 'palas, etc., which is technically called '*porka*'. Latterly, owing to certain rulings of the Forest Laws, the cultivators have to pay Government certain charges for such '*porka*.'

(*b*) The cultivators and other *raiyats*, having to pay certain charges for firewood, substitute cow-dung for fuel, for cooking purposes, etc., etc.

On these grounds in my opinion there is an insufficient supply of manure in the district.

(4) As the district comprises much less of black-cotton soil which is not so well suitable for irrigation, and as it is composed mostly of the sandy '*chilka*' soil well adapted for irrigation purposes, extension of irrigation can be carried out with great advantage.

(5) As the water supply in this district is generally from rain-fed tanks, for the last few years, the uncertain rainfall has been felt by the *raiyats*. In some years the rainfall is scanty, in others the commencement somewhat late, but more so is the cessation rather early.

(6) For the ordinary rice crop in irrigated land, where generally we have two crops in the year, called *abi* and *tabi*, in ordinary years *raiyats* do not feel the lack of funds for the initial expenditure. Of course for more expensive cultivation, such as sugarcane, only well-to-do *raiyats* can undergo it, for, this not merely entails extra capital, but this capital is locked up as it were for about 12 months until the crop is harvested.

(7) This being a settled district where settlement rates have been conditionally fixed, the *raiyats* are not afraid of enhancement of revenue assessment until the expiry of the settlement period.

(8) As our revenue system is raiyatwari, having to deal with the cultivators direct, and as the *raiyats* hold perpetual right of occupancy, provided they pay the Government annual demand regularly, there is no fear of being deprived of their holdings.

(9) Latterly, this district has made good progress as regards irrigation works, and in my opinion there is not much margin left to open out any new sources or to repair old ones with reference to tanks. The large project on the Manjara river at the extreme south of the district is under contemplation. Throwing a dam across the waters of this river, and running a channel therefrom will not only irrigate lands directly under it, but will fill

up many of the rain-fed tanks on its course for miles further. This will help a good deal in years of scanty monsoon, for those tanks under it which are almost all rain-fed, if not filled by rain-fall, are most likely to be filled by this channel.

4. New wells, constructed by private capital, are exempted from enhancement of assessment on account of irrigation, for a period of 15 years, and for a second period of 15 years they are lightly taxed; *i.e.*, at double the dry rates. In cases of small tanks (kuntas) the exemption from enhancement is secured for a period of 30 years. In my opinion the existing provision in respect to new wells is not sufficiently liberal. With a view to encourage the sinking of a large number of new wells by private capital, this rule regarding the acquisition of '*kowl*' by the cultivator, before he sinks a well, should be done away with. He should be at liberty to sink new wells in dry fields whenever he likes. Also the period of exemption from enhancement of assessment should be increased from 15 years to 30 years.

5. The Land Improvement Act is not in force in this district.

6. Extension of irrigation, in my opinion, will not tend to injure the remaining cultivation, by attracting its cultivators to the newly irrigated tracts. In fact, only lately, a big channel is being constructed to supply a large tank in the Kamaredipett *taluka* of this district, under which the wet lands were lying waste for many years past. The *raiyats* have beforehand applied for all this land, not only so, but there are disputes between the different applicants, each party claiming his right to the soil. Although the Irrigation Department has done much good to this district by restoring a good many old sources of irrigation, yet I find a rather strong desire evinced by the *raiyats* to have further means of irrigation extended or increased.

B.—Canals of continuous flow.

7 to 11. We have no canals of continuous flow.

C.—Canals of intermittent flow.

12. (1) Permanent masonry dams or temporary earthen dams are thrown across smaller streams, and a channel is taken therefrom to irrigate wet lands.

(2) The water is distributed to the land by means of these channels.

(3) Up to date, as these dams are thrown across streams having no perpetual flow:—

(*a*) In a year of ample rainfall the supply is maintained for a period of about 6 months.

(*b*) In a year of scanty rainfall hardly 3 months.

(*c*) In a year of drought *nil*.

13. Irrigation under canals of continuous flow, such as the Pangra Project under completion, and the Manjara Project under contemplation, would increase the value of the produce of land:—

(1) by rendering it possible to cultivate two harvests instead of one, *i.e.*, *abi* and *tabi* rice crops instead of *abi* only; which means an increase of produce of upwards of a hundred per cent.

14. the irrigation source will prove to be useless, if—

(1) the water supply is too late, for, there will be no rice sowing at all, while

(2) a too early cessation of the supply will dry up the crop without giving any produce in grain, the harvest resulting in only straw.

15. Channel irrigation is in some instances supplemented by irrigation from wells, where the water supply is not sufficient for the whole period for a single crop; where it is sufficient for the first crop only, a second crop is taken up by well irrigation. In some instances, wells are reserved to fall back upon in case the channel water supply falls short for that crop, owing to scanty rainfall, or for some other reasons. Supplementing channel by well irrigation is, in my opinion, essential where the rainfall, as well as the channel water supply, is so precarious in this district.

16. If dry lands are brought under irrigation and sown with rice, which is the chief wet crop in this district, the approximate estimate of the increase with the total annual value of the produce per acre would be—

(1) on the average of a normal term of years about Rs. 40, if only a first crop of *abi* is taken; and about Rs. 50, if a second crop of *tabi* is also taken;

(2) in a year of drought *nil*.

17. The average annual rate per acre, paid on account of irrigation by the occupant of the land to Government, is *abi* Rs. 12, *tabi* Rs. 18, and double crop Rs. 26. The above includes land assessment as well as water rate.

(1) There are no private canals in the district. The assessment is collected on the total area of each holding and no partial remission of a field is granted. In case the whole field is left fallow on account of insufficiency of water supply or any other valid cause, over which the *raiyat* has no control, full remission is granted. In case of insufficiency of water supply, if the *raiyat* grows a dry crop, only a dry crop rate is assessed.

18. If any private expenditure or labour is necessary to bring the water to the fields that are close by, or to prepare the lands for irrigation, this is generally incurred by the tenants who are cultivators and not by the landlord, *i.e.*, the Government. But in cases where there are main channels running for long distances, they are maintained by the landlord, *i.e.*, Government.

19. Irrigated lands, as a rule, are generally manured; if not, the produce would be hardly half. Too profuse, too extensive or too frequent irrigation would not affect to any extent the rice crop generally grown in this district, for it has always to be kept under 2 to 3 inches of water from the time the young shoots are two or three inches above ground, to the time of about a week before it is harvested. For the above reason, water logging would not affect it, neither is the draining of such lands needed. Salt-efflorescence is seldom observed in this part of the country. Of course water logging or frequent irrigation may affect the sugarcane crop, which is not much grown compared with the rice crop. Hence, generally, as a rule, the land selected for sugar-cane growing is always on a higher level than the adjoining lands.

20. The main and larger channels from tanks, *nalas*, etc., are maintained by Government, while the minor ones are maintained by the cultivators themselves. Maintaining these channels alone would not cost eight annas per acre irrigated; while to maintain the head-work as well as those channels costs Government at the very maximum 10 per cent of the revenue, and in some instances less. This system in my opinion works fairly well and needs no legislation.

21. There are no channels constructed by private persons in this district.

D.—Tanks.

22. (1) The tanks in this district are generally supplied with rain water and in very few instances supplied with water from a dam thrown across a *nala*. But generally speaking the tanks in this district are all rain-fed.

(2) Sluices are constructed on tank bunds from which the distributing channels are carried and multiplied to meet requirements, and thus the fields are irrigated. The water at the sluice can be regulated, for which "Neerdies" are appointed by Government, who work under the supervision of the village officials and distribute the water in proportion to the area irrigated.

(3) (*a*). In a year of ample rainfall, the larger tanks maintain the water for almost the whole year, *i.e.*, for the double rice crop. While smaller tanks called (kuntas) can maintain water for only the first crop of rice, *i.e.*, six months.

(*b*) In a year of scanty rainfall, the larger tanks could irrigate only the first crop of rice, *i.e.*, six months; whilst the smaller tanks (kuntas) would with difficulty maintain water for a period sufficient to grow the first rice crop.

(*c*) In a year of drought *nil*.

(4) The area irrigated from a tank would be from 30 acres to about 2,000 acres, so that the ordinary or average tank would irrigate about 100 to 150 acres.

23. Reply as per answer No. 18.
24. Do. do. do. 14.
25. Do. do. do. 15.
26. Do. do. do. 16.
27. Do. do. do. 17.
28. Do. do. do. 18.
29. Do. do. do. 20.

30. There are no private tanks in this district.

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31. There is almost a sufficiency of tanks for irrigation purposes already provided by Government in this district, while there are still a few that have breached and are in disrepair, for the restoration of which Government annually allots a certain sum of money; hence, in my opinion, it is not necessary, nor do I consider it advisable, to encourage the construction by private persons of further new tanks. Here I might remark that '*kowls*' issued for new kuntas (small tanks) should be likewise issued for kuntas that are in a dilapidated state and under which no land has been irrigated for years past. This might tend to increase the irrigation to a little extent.

32. Undoubtedly tanks are gradually being silted up owing to which its capacity for holding water decreases, and consequently the irrigated land under it also gradually decreases. There are no means adopted for preventing the ultimate silting up of the tanks. But often, whenever the tanks are silted, the bund is generally raised, which increases the capacity of the water. In my opinion this method commends itself as being equally efficacious and cheaper.

E.—Wells.

33. In nine out of the ten *talukas* of which this district is composed—

(1) the average depth of permanent wells is from 6 to 10 yards. In the tenth *taluka*, Mudhol, which is partly Mahratwara with deep black cotton soil, the wells are from 20 to 30 yards deep.

(2) The nature of the supply is generally as a rule from percolation and,

(*a*) in an ordinary year the water is not liable to fail or become too saline to use.

(*b*) in a year of drought these wells require sinking deeper as was the case in the year 1899-1900.

(3) The average cost of construction for the wells in general in this district may be said to be from Rs. 50 to 75. The reason for this cheap rate is that they only require excavating the soil, and are not as a rule built in. In some instances one side only is built in with loose stone to put up one or more '*mots*'. In other instances a wooden platform is constructed for working the '*mot*'.

(4) As regards the average duration of a well, the above description requires silt clearing almost every year, and where the '*mot*' construction is of wood it requires renewing every four or five years.

(5) The water is usually raised by means of a '*mot*' worked by one pair of bullocks.

(6) The average area attached to and commanded by a well depends upon the percolation or water supply, and consequently the number of '*mots*' attached to it. The average area attached to and commanded by a '*mot*' is two acres, while the wells are generally of one '*mot*' and in some instances two or more.

34. Well irrigation is generally utilized for the second or hot weather rice crop, whilst it is seldom utilized for the first or monsoon crop. The reason for this is that, during the monsoon, it is difficult for the bullocks to work the '*mot*' on account of the soil being soft and slippery.

(1) For the above reason, it is difficult to cultivate two harvests instead of one by well irrigation.

35. An approximate estimate of the increase in the total annual value of the produce per acre due to irrigation would be—

(1) on the average of a normal term of years about Rs. 60 (*i.e.*, Rs. 10 more than tank water irrigation for a *tabi* crop, as well water is said to give a greater produce);

(2) in a year of drought there might be a contraction of the area under the well for want of sufficient water, but the produce per acre would be about the same.

36. The average annual rate per acre paid on account of irrigation under wells is about one half of that paid for irrigation under tanks and canals and might be said to be about Rs. 10 per acre. These rates are paid, on the total area attached to and commanded by the well, by each holder and not on the area actually irrigated during the year.

37. No serious difficulties are encountered—

(1) in the selection of a spot in which a supply of water could be obtained; and

(2) in the actual construction of wells.

Because the water lies generally on the surface of the soil and does not require deep boring; as also wells are seldom 'pucca-built' but are simply large deep pits.

38. I would, by no means, suggest the construction by Government of wells in land which is private property; but would strongly propose that the *raiyats* be given a freer hand in sinking new wells in their dry lands at their own cost for a longer term of years without taxing the water, as explained in paragraph 4 of these notes.

39. Temporary wells are commonly used in this district. They are a great protection against drought as experienced in the year 1899-1900. The cultivators would sink a greater number of new wells in a year of scanty rainfall, provided, as already recommended in paragraph 4 of these notes, the restriction with regard to the acquisition of '*kowl*,' and the period of exemption from enhancement of assessment was relaxed. Even with the existing rules, as explained in paragraph 4, during the year 1899-1900 when there was a scanty rainfall in this district, about 300 new wells were sunk.

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(13) *Moulvi Abdur Rahim Sahib, Superintendent of Revenue Survey and Settlement, Hyderabad Division.*

Answers to printed questions.

A.—General.

1. The following answers refer to the district of Warangal in the Dominions of His Highness the Nizam.

I had been the Settlement Superintendent of this district for over 12 years, and the whole district was settled by me. I have toured throughout the whole district many times, and I know every inch of it.

2. The average rainfall in the district as gauged in its various tehsil offices and as stated in my Settlement reports is as under:—

Name of taluka.	Average rainfall for last 10 years (1300 to 1309). Inches.
Warangal	29·76
Chiryal	28·14
Wardannapet	30·33
Parkal	32·66
Khammamet	36·91
Mahbubabad	30·85
Yelladdapad	32·19
Madhra	32·19
Pakhal	37·09
Palwancha	34·31

The average annual fall as shown above is 32·57 inches. But since the rainy season lasts for 4 months, the average rainfall per month amounts to 8·14 inches.

3. Obstacles to the extension of irrigation:

(1) Sparsity of population. One noticeable feature of the district is its general sparsity of population owing to its peculiar natural conditions as will be described later.

The population of the district in the three consecutive census taken in 1881, 1891 and 1901 respectively was as follows:—

Year.	Population.	Increase per cent.
1881	675,746	...
1891	863,129	26·25
1901	952,646	11·67

It is plain from the above that the population increased at the rate of 26·25 per cent. during the decade ending 1891, while the rate of increase during the decade ending 1901 was only 11·67 per cent.

The average population of the Warangal district in the census of 1891 amounted to 87·2 per square mile of the gross area against 151·2 and 151·8 in the adjoining districts of Nalgundah and Elgandal respectively, and the same in 1901 amounted to 97·4 against 169·4 and 143·7 respectively. Warangal is one of the sparsely populated districts of these Dominions.

According to the known law of population (the Malthusian doctrine), population doubles itself within 20 to 25

years under certain ideal conditions; first, the existence of fertile soil producing ample means of subsistence, and second, absence of counteracting influences, such as plague, pestilence, war, famine, and the like. But the case of the Warangal district affords a peculiar exception to the above doctrine, for, even when not arrested by any positive or preventive checks, the increase in its population during the two decades ending 1901 is only 10·9 per cent., that is, in a period which is long enough to have doubled the population under the above doctrine. Thus the actual rate of increase is so slow and precarious that it must be accounted for by the peculiar physical conditions of the district. The causes for such a slow increase in my opinion are the following—

1. The climate of the district is generally insalubrious and more especially, the climate is so unhealthy in Pakhal, Palwancha, Mahbubabad and Yellandapad *talukas* that most of the villages thereof are deserted and large tracts of cultivable lands are lying fallow for mere want of men to cultivate them.

2. The second cause is the reservation of large tracts of forest lands and the prohibitive nature of the laws of the Forest Department.

3. Even in healthy places large areas of land once under rice cultivation and yielding a considerable revenue, are now lying waste merely for want of proper irrigation; and hence many whose occupation is agriculture have left these places for others where they can live by cultivation.

Thus if sparsity of population is an obstacle to the improvement or extension of irrigation, it is pre-eminently so in this district. But at the same time, there can be no doubt whatever that improvement of irrigation will increase its population.

3. (2) Insufficient supply of cattle.

There is no scarcity of cattle in this district. There being large areas of waste lands which afford good pasture, cattle are necessarily more numerous here than elsewhere or than the requirements of the district. But the fact is that many of the indigenous bullocks of some of the *talukas* of this district being of a specially good breed, they command a ready sale in the nearest British markets and other places in these Dominions and fetch a large profit to their owners. Thus cattle are regarded more as an article of trade in this district than as a factor of the agricultural stock, for this mere reason that there are not sufficient areas under cultivation to enable the *raiyats* to keep all their cattle engaged in agriculture The average number of bullocks in the possession of each puttadar is 2 pairs and the average area per each pair is 11 acres, while in the Nalgonda and Elgandal districts the average number of bullocks is 21 and average area 12 acres. This clearly proves that the agricultural stock is more favourable in Warangal than in the other two districts.

3. (3) Insufficient supply of manure.

Owing to the existence of a large supply of cattle in the district, there is an abundant supply of cattle manure available for cultivation. But since the extent of cultivation in this district is not as it ought to be, a good portion of cattle droppings is left unused. Rice lands are manured once a year or even oftener whenever possible and the method of manuring is almost the same as in other places, namely, by folding sheep and goats in the fields and utilizing their droppings for manure.

3. (4) Unsuitability of soil.

The district of Warangal being the type of the Telingana portion of the Dominions of His Highness the Nizam, a continued expanse of soil of the ferruginous species, or as it is commonly called 'black cotton soil' is only a rare exception here rather than the general rule. It is true that patches of regar lie intermixed with soils of other species here and there, but its percentage in each *taluka* and in the whole district is very low, as shown in the following table—

Taluka.	Percentage of regar.
1. Warangal	36·93
2. Chiryal	4·93
3. Parkal	47·85
4. Wardanapet	4·01
5. Khammamet	11·22
6. Mahbubabad	1·64
7. Yellandapad	4·78
8. Madhra	15·43
9. Pakhal	46 74
10. Palwancha	15·05
Average	19·76

Hence there is very little regar soil in the district that can afford a serious obstacle to the extension of irrigation.

3. (5) Uncertainty of the supply of water.

The uncertainty or rather the insufficiency of water supply and the consequent loss of cultivation, are phenomena of frequent occurrence in the Warangal district. As far as I have seen and as borne out by statistics in every quinquennial period, there are scarcely two years of ample rainfall in the district, so as to give it a sufficient supply of water for cultivation, and what the *raiyats* call water enough always proves little enough. One characteristic peculiarity of this district is that the rainfall here is neither uniform nor even throughout the whole area, one particular part or other getting an extra share of this bounty every year. The result is that the ignorant *raiyats* always overestimate the supply of water available, and prepare a large area of land for cultivation, without making any allowance whatever for the inevitable loss caused by evaporation percolation, etc., and without forming an accurate idea of the prospect of the season, and at last when the season fails as it invariably does in this district, all their labours and money are lost.

To illustrate the above, during the last 10 years there were only three years, *viz.*, 1306, 1308 and 1309 Fasli in which the rainfall was scanty while in the remaining seven years it had reached the usual average of the district. Nevertheless in none of the seven years was rice cultivation just as could be expected, for the rainfall was quite out of season in many places and rice cultivation had therefore failed there. Again the years, 1302, 1303, 1301, 1307 Fasli were exceptionally good for rice in this district, but even in these years remissions had to be granted to the extent of Rs. 6,50,688 owing to a total or partial failure of crop caused by insufficiency of water-supply as detailed below—

Fasli year.	Average rainfall.	Remissions granted
		Rs.
1302	39·21	3,30,534
1303	43·60	3,16,914
1304	34·65	6,50,688
1305	40·30	6,29,459

Since the sources of irrigation in this district consist exclusively of rain-fed tanks, the only way in which irrigation can be improved here is to repair the existing sources and lay out new ones wherever they may be required. But even then the uncertainty of the supply of water caused by the caprice of nature may remain unobviated. However, an attempt is being made with considerable success, I may say, to remove this obstacle to a certain extent by encouraging the *raiyats* to sink wells at their own cost on liberal conditions offered by Government.

Too late commencement of water-supply and too early cessation of it are of frequent occurrence in this district but as far as I can see, neither of these can in any way obstruct the improvement or extension of irrigation.

3. (6) Lack of capital.

All that can be said at present on the subject is that, since the *raiyats* of this district, as well as those of the other districts of the Telingana country, are proverbially poor, if the improvement or the extension of the sources of irrigation were left exclusively to private enterprise, it can never be done with any success, for during a period of 30 years, for which statistics are available, the *raiyats* have actually made no more progress in improving irrigation than carrying out petty repairs and constructing some minor works.

3. (7) Fear of enhanced assessment.

The revenue settlement in these Dominions is based on the raiyatwari system, and is subject to periodical revision now once in 15 years. Although in the district of Warangal the original settlement itself is yet to be completed, and there have, therefore, been no instances of enhancement of rates during revision, owing to improved irrigation or cultivation of more valuable crops, still the system adopted in the case of a few *talukas* that had recently been re-settled in Mahratwara clearly shows that there is no fear of an enhancement in the assessment on improvements made by the outlay of the *raiyats'* own labour or capital. The lands are not to be re-classed during revision, and the Government simply comes in for a share of the "unearned increment," that is, profits accruing to the *raiyats* from causes that are quite beyond their control. Thus there is a perfect security to the *raiyats* as far as enhancement of the assessment is concerned and they are allowed to enjoy the full benefit of their own improvements over and for ever.

3. (8) The territory of His Highness the Nizam, like the other parts of India, is pre-eminently a country of peasant-proprietors with small holdings, and its agricultural interest is therefore of considerable importance; and

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the district of Warangal is no exception to the general rule. All cultivated and cultivable lands are property of Government, and lands are held by peasant cultivators under what may be called "the Survey Occupants tenure", and there are no restrictions whatever on the universal freedom of contracts. No registered occupant can be ousted from the possession of his holdings as long as he continues to pay his assessment regularly to Government, and there are no coercive sales of lands except under distress for arrears of revenue, or under the orders of a Court of Justice to discharge a liability imposed on the land by the voluntary acts of its owner. Thus land-tenure is perfectly secure, and there is no uncertainty in it that might afford an obstacle to the improvement of irrigation.

There is no Tenancy Law in these Dominions enacted by the Legislative body. All questions relating to tenancy are considered then and there by Government and disposed of in General Circulars or orders. Thus, the Tenancy Law of the country consists of a few Circulars, etc., issued by Government from time to time.

3. (9) *Other reasons.*—Among the various other causes that tend to obstruct the improvement of irrigation in the district I may mention :—

i. Unevenness of the surface. The district of Warangal is remarkable for huge rocks and hills which render its surface extremely undulating. In almost every village of the district, a portion of the land has to be left uncultivated owing to the presence of these rocks and high grounds. Hence any improvement of irrigation can only be local and none can be devised so as to benefit the whole district at once.

ii. The second obstacle in the way of improving the irrigation of the district is the want of a river or a perennial stream that can afford an infallible supply of water. No doubt, the Godavari runs alongside the whole of the eastern boundary of the district, but its bed is so low that its water cannot rise to the surface of the country except by some extraordinary contrivance.

Further, even if the water were brought up to the level of the surface, it cannot flow through, because the surface is very uneven and full of dense forest for miles together.

Thus such an attempt may produce some success, but this success can never be proportionate to the troubles of the undertaking.

4. There are some irrigation works constructed by private capital in this district by the *raiyats* at their own cost. During the last 30 years, for which statistics are available, about 22,206 acres of land yielding an aggregate revenue of Rs. 1,15,156 have been brought under irrigation by works of this kind. As a special concession granted by Government, such *raiyats*, already paying dry rates on these newly irrigated lands, will continue to pay them for a fixed period varying from 30 to 40 years.

This system has been modified and a uniform "Kowl system" (the lease of cultivated and culturable waste lands) has been introduced. Under this system dry lands are converted into wet at the *raiyats'* own expense by sinking wells and repairing minor tanks, and the concession allowed by Government to such *raiyats* is that, for the first 15 years of the lease, they only pay the usual dry rates and for the next 15 years double the said rate; and after the expiry of 30 years, which is the maximum period allowed for leases of this kind, the improved lands are assessed at the usual wet rates.

The procedure adopted in granting kowls is that the Kowldar first applies to the local revenue authorities, specifying the lands which he intends taking up and when the application is finally sanctioned, a kowlnamah (lease-deed) is issued by competent officers setting forth various conditions on which the lease is granted, and this lease-deed is, as it were, the Kowldar's sannad.

The provisions made by the Government in this behalf are liberal enough, but the period of 15 years allowed for such leases generally proves insufficient, for, in many cases, especially in these hard days of famine and uncertain monsoons, this period is too short for the *raiyats* to recoup their capital in full. I am therefore of opinion that the dry rates should be levied for the full period of 30 years instead of levying them only for the first half and doubling them for the second half of the said period.

5. There is no law in this country regarding the payment of loans to the *raiyats* for the purpose of improvement of lands, similar to Act No. XIX of 1883 of the Government of India, and herein lies the fundamental cause of the general poverty of the *raiyats*. For want of proper encouragement from the Government, the *raiyats* are under the painful necessity of borrowing money from local usurers whose rate of interest is abnormal and who most mercilessly squeeze out even the last pie that the *raiyats* can afford, in some form or other. The result of this is that the *raiyats* are always in debt, and so poor and so devoid of all staying power, that they succumb on the very first approach of an unfavourable season. Since a strong peasantry is alone the backbone of a good Government, it is very necessary that the Government, in its own interest, should endeavour to relieve its subjects from their miserable condition. for, as has once been remarked by an illustrious native genius—"the elements of national prosperity are wanting in a country whose principal resource is agriculture, and that agriculture is in the hands of a thriftless and poverty-stricken peasantry;" and John Bright would say—"if a country be found possessing a most fertile soil and capable of bearing every variety of production, and that notwithstanding, the people are in a state of extreme destitution and suffering, the chances are, there is a fundamental error in the Government of that country."

I am, therefore, of opinion that the want of an Agricultural Bank, or some law for paying loans to agriculturists for land improvement, is very keenly felt in these Dominions, and the Government cannot, therefore, attend to this important subject one moment too soon.

6. There is no fear of any extension of irrigation tending "to injure the remaining cultivation by attracting its cultivators to the irrigated tracts." There is an ample supply of agricultural cattle in the district, there is a large quantity of manure available, and the chief occupation of the people is agriculture; and hence the *raiyats* of this district always want more land for cultivation, and there is therefore no fear of their relinquishing their present holdings and taking to the cultivation of newly irrigated lands. Further, experience clearly shows that, in addition to cultivating the lands already in their possession, the *raiyats* of this district have not been hesitating to carry their agricultural stock even to distant parts and there cultivate new lands whenever available. For instance, the Ghanapur tank in the Parkal *taluka*, lying as it does amidst thick forests and jungles and in a most unhealthy locality, had not even an inch of land irrigated under it when it was in a dilapidated condition. But nevertheless as soon as it was repaired and restored to its proper condition in 1305-1306 Fasli, nearly a thousand acres were applied for and taken up for cultivation, and a large number of applications had to be rejected simply for want of sufficient lands to meet the demand.

Again, even the Pakhal lake, its proverbial unhealthiness, etc. notwithstanding, is not without attraction; large numbers of cultivators go with all their agricultural stock from long distances to this unhealthy region, simply for cultivating the lands under it. Thus it is plain that a good supply of water is all that is wanted in this district to bring even the worst lands under cultivation.

Want of proper irrigation is the common cry throughout the whole of the Warangal district. In my periodical tours as a Settlement Officer in the various parts of this district I spared nothing to induce the *raiyats* to take up waste lands for cultivation, but improvement of irrigation is the condition precedent to their undertaking it; and this fact has been referred to in many of my settlement reports.

B.—CANALS OF CONTINUOUS FLOW.

7, 8, 9, 10 and 11. There is no irrigation under "Canals of continuous flow" in this district.

C.—CANALS OF INTERMITTENT FLOW.

12—(1). There are two kinds of canals of intermittent flow in this district, first, those that issue from big tanks, and of which some are even called rivers, such as the Pakhal river issuing from Pakhal lake and the Laknawaram river issuing from the Laknawaram tank, and the river Moramcha from the Ramappa lake and so on; and the second kind of canals are mere hill-streams which irrigate some rice lands in their course, as is found in the *taluka* of Pakhal, &c.

12.—(2) The water of the canals is diverted into small irrigation channels by means of anicuts or temporary dams thrown across them, and through these channels it is carried to rice fields.

12.—(3) (*a*) In a year of ample rainfall, the supply of water in the first kind of canals lasts throughout the year, and the supply in the second kind lasts throughout the rainy season only.

(*b*) In a year of scanty rainfall, the first kind of canals contains water for the whole of the first crop, and perhaps a small supply of it for the subsequent crop too; whereas the hill streams become quite precarious.

(*c*) In a year of drought, the supply of water runs short in both kinds of canals.

13.—(1) One peculiar feature of the system of assessment in this district is that its first crop called *abi*, or winter crop, and its second crop called *tabi*, or summer crop, are assessed alike, and that, if two crops are raised on one and the same land, the total assessment leviable for both crops is 1½ times the assessment for a single crop of rice, and the average value of the produce per acre is increased in the same proportion, *i. e.*, 50 per cent. more than that of the single crop. But since the above canals depend entirely on rainfall, and great inconvenience and difficulties are experienced even in raising the first crop under them, no hopes could be entertained of reaping two crops under such precarious sources of irrigation. The only increase that could be expected by improvement of irrigation under these canals is that waste lands amounting to 1,610 acres, bearing a revenue of Rs. 14,350, will be absorbed under cultivation.

13.—(2) The valuable crops such as sugar-cane, &c., could not be raised under those canals, the supply of which is uncertain as stated above. Hence the increase cannot be estimated.

13.—(3) (*a*) In a year of ample rainfall, irrigation increases the revenue in three ways, namely—

(i) by increasing the quantity of produce which an acre of land ordinarily yields;

(ii) by tending to bring a considerable area of irrigable waste lands under cultivation; and

(iii) by enabling the *raiyats* to raise two crops instead of one in suitable places. The increase in the value of the produce in such a rare bumper year generally ranges from 40 to 50 per cent., when compared with the produce of a normal year.

(*b*) In a year of scanty rainfall, the produce of land is bound to decrease in proportion to the scantiness of the water supply. It is a matter of every day experience that whenever the rainfall is scanty, it is also often irregular, so that a fail out of season completes the destruction begun by its absence when actually required. An accurate estimate of the loss caused by scanty rainfall is not quite possible at the present moment, but, however, the loss is generally found to vary from 50 to 75 per cent., when compared with the produce of a normal year.

(*c*) In a year of drought, the cultivation of wet crops is out of the question, and hence the loss amounts to cent. per cent.

14. (1) and (2) Too late commencement and too early cessation of water-supply are injurious to cultivation, and the loss of revenue arising from the former may be roughly estimated at 30 per cent., while the loss from the latter amounts, in many cases, to cent per cent.

15. As stated above, there are two crops raised on irrigated rice lands. In raising the first or the winter crop, the water required is drawn partly from these canals of intermittent flow, and partly from the rains direct, and hence, there is no necessity for supplementing the irrigation from wells, as far as this crop is concerned. But the case of the summer crop is somewhat different; for during the hot season these canals cannot be very much depended upon, for the very tanks from which they take their rise, run short and a good deal of the irrigation is therefore obtained from wells; and since this difficulty is, to some extent, peculiar to this district, the number of such auxiliary wells is more numerous here than elsewhere, The number of these wells under tanks and canals in this district is 7,807 against 3,000 in the Indur district. However, although what has been stated above points to the general practice obtaining in this district, a winter crop under wells is not a thing unknown here.

16 (1) The average commutation price of the yield per acre of dry lands, as actually ascertained by crop experiments, amounts to from Rs. 6 to Rs.10 and that from an acre of irrigated rice land ranges from Rs. 26 to 35, so that the increase in the yield per acre brought on by irrigation amounts to from Rs. 20 to Rs. 25.

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The actual annual average yield per acre for a normal term of years, say for the five years ending 1305 Fasli, was as follows:—

	1301 F.	1302 F.	1303 F.	1304 F.	1305 F.	Average.
Dry	10	6	6	8	10	Rs. 8
Wet	26	35	35	31	26	„ 31

(2) In a year of drought, there may be dry crops grown to some extent, but the cultivation of rice which solely depends upon water, is impossible, and hence no comparison can be instituted in such a year.

17 (1) The system of settlement followed in these Dominions is to assess all wet lands at one consolidated amount, which consists of the assessment of land and water, and there is therefore no separate water-cess that can be definitely calculated. Further, the Government is the ultimate owner of all lands, and all sources of irrigation (except those that have been constructed by private captial) are its own property; and hence, every kind of assessment, namely the assessment on land alone, as in the case of dry lands, and the consolidated amount for land and water as in the case of wet lands, goes to Government. There is no Canal Company here to which any water cess is paid.

The only instance in which a distinct water-cess is paid to Government is the case of Inamdars, etc., who are charged for the water supplied to them by Government, at the rate of Rs. 1-14-0 per acre for the winter crop, and Rs. 3-2-0 for the summer crop, making up a total of Rs. 5 for both crops of rice.

(2) The district of Warangal has been regularly settled and the settlement rates have been guaranteed for a period of 15 years; and hence, the Government (the ultimate owner of lands) cannot claim any enhancement of rent due to irrigational improvements carried on during the continuance of the said guarantee. The Government of course reserves to itself the right of claiming an extra benefit for its own works, that is, if dry lands are converted into wet, or single crop rice lands into double crop lands, owing to the improvements introduced by Government; then the lands are assessed then and there according to their improved quality. In no case, whatever, can the maximum rates once guaranteed be enhanced before the expiry of the period of guarantee.

(3) The only instance in which the owner of the land pays water advantage rate to Government is the case of Inamdars, and this has been explained under paragraph 17 (1) *supra*.

(4) There is no Canal Company in this district, and there is therefore no royalty paid by it to this Government.

The levy of the wet rates above referred to, either in whole or in part, is governed by the following circumstances, namely:—

(i) if water were available only for the portion that is actually cultivated, and the remaining lands have to be left uncultivated for want of water or owing to the insufficiency of the supply, then the rate of assessment is levied only on the portion that is actually under cultivation; but

(ii) if the whole, or any part, of a holding is left uncultivated for any cause other than the insufficiency of water supply, then assessment is levied on the entire holding as if it were actually cultivated.

18. The expenses of bringing water to the fields and of preparing the land for irrigation form two factors in the cost of production, and these expenses are borne by the cultivators and not by the Government. They only amount to a small sum and yet they are duly taken into account in calculating the expenses incurred by the *raiyats*.

Security for recoupment.—The expenses of cultivation are first of all deducted from the gross income derived from an acre of land, and out of the remainder a further deduction of 10 per cent. is made for causes beyond the control of the *raiyats*, and out of what then remains, the Government generally takes one-half for its own share of the land revenue, and this rate is guaranteed for a fixed period of time. Thus, the balance from which the *raiyats* pay their assessment to Government excludes the expenses they have incurred in bringing water to the fields, in preparing the land for irrigation, and the like.

19. Want of manure tends to cause earth-butchering, and if the same state of things continue for two or three years consecutively, the soil completely loses its fecundity and has to be ultimately thrown out of cultivation.

Too profuse and too frequent irrigation greatly damages the crops; the seedlings become stunted and they do

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not grow as under normal irrigation. In the case of water-logging, the roots of the plants generally decay, and the crop ends in a failure. Salt efflorescence, commonly called *karl* in these parts, is the result of too profuse an irrigation in *regar* lands under rice. This kind of soil is less porous and more retentive of moisture than the ordinary *chilka* land, and there seems to be something peculiar in the chemical composition of it (which has not been ascertained), which aids the formation of salt when water remains on it for a long time. The *raiyats* suggest that profuse manuring is the only remedy for this defect. But by actual experience, this has been found to be only a partial remedy, for, even when properly manured, such lands yield only less, say, from 20 to 50 per cent. less than others without this defect. In my opinion, frequent renewal of the soil followed by profuse manuring may tend to remove this defect completely.

20. The cost of the maintenance of these canals is borne by Government and the average expenditure of such maintenance per acre cannot even be roughly estimated now for want of necessary statistics.

21. There are no canals constructed by private persons in this district and hence the troubles and difficulties experienced in regard to the supply of water, etc., are unknown here.

22. I am not in favour of encouraging the construction of new canals by private persons, and there are but very few cases where such canals could be introduced. But on the contrary, I would strongly recommend the restoration of old anicuts which have been lying in a ruinous condition for many years past.

D.—Tanks.

23. (1) The tanks in the Warangal district are generally rain-fed tanks, though a few of them have artificial feeders.

(2) The water is distributed to fields by means of channels and sub-channels that issue from sluices of tanks.

(3) (*a*) In a year of ample rainfall, the water is maintained in the tanks for a period of ten to twelve months.

(*b*) In a year of scanty rainfall, if the season commences early, water is maintained only for three months, and it is just sufficient for the *abi* or winter crop. But if the season commences late, the water remains for four or five months, and in this case, the *tabi* or summer crop is benefited.

(*c*). In a year of drought, there is no water to be maintained.

(4) The extent of irrigable area under tanks depends chiefly on their capacity. In the Warangal district this varies from 50 to 500 acres and some of the largest tanks in the district, namely, the tanks of Nagaram, Pakhal, etc., irrigate to an extent of 4,000 to 8,000 acres respectively. The average irrigable area is 125 acres under each tank.

24. As explained under canals (question 13) if two crops are raised instead of one, one and a half times the assessment of the single crop is only levied by Government, and the increase in the average value of the produce is also reckoned 50 per cent. more than that of the single crop. There are already 93,689 acres of single crop rice lands under tanks yielding an actual revenue of Rs. 8,90,133 and there are also 23,084 acres more which are now lying fallow simply for want of proper irrigation. Thus, if irrigation were improved, these waste lands would also be taken up for cultivation, and the total revenue to Government will then amount to Rs. 10,84,680. This figure only represents the income derived from a single crop of rice, and if irrigation were so improved as to convert all the single crop lands of the district into double crop lands, there will be a further addition of one-half of the said amount. But this cannot be done. For, my long experience of the district warrants my conviction that the double crop will never increase by such rapid strides as to cover every inch of land available for the purpose. In my opinion, the present area under double crop which is 13,039 acres, may at the most be doubled. In this case, the probable addition to the revenue will only amount to Rs. 1,00,000.

(2) The only crops more valuable than rice that are generally raised on irrigated lands in the Telingana country are sugar-cane and betel-leaves, of which the former is an eighteen months' crop and assessed at double or treble the maximum rate fixed for a single crop of rice, and the latter at one and a half times the said rate. These two crops require at least twice the usual supply of water required for a single crop of rice. But in a district like Warangal where the sources of irrigation are so precarious that thousands of acres of single crop rice lands are lying fallow for want of proper irrigation, the cultivation of crops, such as sugar-cane and betel-leaves which require more water than rice, is out of the question. However, it may not be out of place to mention here that, out of a large area of 152,038 acres of Government irrigable lands in the whole district, the area under sugar-cane is 110 acres and betel-leaves 12 acres only. Thus it is clear that the cultivators here are not disposed to cultivate valuable crops as has been the case in the other Telingana districts of these Dominions. Perhaps, improvement of irrigation may tend to change the aspect of the district by inducing the people to take to sugar-cane and other valuable cultivation, and if so, as has been already explained, the profit arising from this cultivation will be more than double that derived from a single crop of rice, for every acre of land that might be brought under this cultivation.

The answers to questions 3, 24, 25, 26, 27, 28, and 29 are the same as those to questions 13, 14, 15, 16, 17 and 18.

30. There are two ways in which the maintenance of tanks, is provided for—

(i) under the direct management of Government; and

(ii) through private agencies under what is called the *dustband* system, as described below—

(1) "By *dustband* which may be given in the shape of Inam land, at the rate of one-tenth the area of land irrigated by the tank or in cash at the rate of one-tenth revenue (exclusive of local Funds) derived from the land under the tank.

(2) "By a permanent reduction in the assessment of land held by the lessee.

(3) "Amount expended to be repaid in a certain number of years by deductions from the revenue of the land under the tank.

(4) "A combination of the *dustband* and reduced rate systems, *i. e.*, reduced rates for a certain number of years and *dustband* for future maintenance."

The above *dustband* system works satisfactorily and there is therefore no need of any further legislation.

31. The answer to this question is the same as that to question 21 *supra*.

32. Any attempt at constructing new tanks must surely be premature in the present state of the sources of irrigation in the Warangal district; for such an attempt presupposes that the existing arrangements are just as they ought to be. The fact is that, in this district, there are numberless tanks in a ruinous condition and large areas of culturable wet lands have therefore been lying fallow for want of proper irrigation. Hence, the first thing to be done is to restore these tanks to their proper condition and then see if new ones are still required to make up the deficiency. The repairs of tanks may be carried on either directly by Government or by the *dustband* system described above; and since the latter system has been found to work well, all that remains to be done is to induce its circulation to the widest possible extent.

33. The accumulation of silt in tanks is no doubt a source of great inconvenience to irrigation, for, it gradually tends to reduce the depth and the capacity of the tanks. The average annual depth of silt accumulation varies according to the fall of the country and the nature of its soil, and hence it is that the deposit of silt in *regar* lands is nearly double and even treble, than in *chilka* lands. The quantity of silt deposited every year is estimated at 2 to 9 inches, and I know of no process by which this is being cleared up either year after year, or even once in a few years. There is, however, one practical method by which the inconvenience or loss caused by silt accumulation is being obviated here—it is by raising the tank-bunds instead of resorting to the more expensive method of removing the silt. This has tended to raise the beds of tanks to a higher level and restore their capacity by raising their escape water-weir; and this process has also tended to bring the higher lands into cultivation.

E.—Wells.

34. The district of Warangal is divided into 10 *talukas*

and the average depth of permanent wells in each of them is as under:—

		feet.
i	Warangal	30
ii	Wardannapet	25
iii, iv, v, vi, vii, viii	Parkal, Mahbubabad, Khammamet, Yellandapad, Madhra, Palwancha	20
ix, x	Warangal, Pakhal	15

(2)—(*a*) In all the *talukas* generally, wells situated at a considerable distance from tanks are fed by springs, while those that are situated in rice fields under tanks are fed by percolation. In an ordinary year there is an ample supply of water in both kinds of wells, and the crops raised under them seldom suffer for want of water.

(*b*) In a year of drought, the supply of water in wells greatly diminishes, and the area irrigated under them scarcely amounts to one-half of that irrigated in a year of ordinary rainfall.

(3) The average cost of construction of permanent wells in all the *talukas* is very nearly the same, and as pointed out by the *raiyats*, it amounts to Rs. 250 to Rs. 400 per well—the average well being taken as a well containing 2 *mots* and capable of irrigating 4 acres of rice land. The cost increases with the provision for extra *mots*, and there are wells in the village Ghanpur of the Wardannapet *taluka*, of which some contain 6, and others as many as 10 *mots* and the cost of which therefore amounts from Rs. 800 to Rs. 1,000 per well. But such wells are only very rare in the district, and even where they are, they belong to rich land-holders, Zemindars, Patels, Patwaris, etc. On the other hand, the cost of the wells situated in rice lands ranges from Rs. 15 to Rs. 50, and such wells exist in large numbers throughout the district.

(4) Permanent wells generally last from 30 to 40 years, while those situated in rice lands only last for a couple of years, nay, some of them are even renewed every year.

(5) Water from permanent wells is generally raised by means of *mots* and worked by bullocks in pairs, while water from the other small wells which contain no *mots* is generally raised by manual lifts called *yatams*.

(6) The area attached to each well depends on the number of *mots* with which it is provided, and such an area averages from 5 to 10 acres per well, one-half being utilized for the first crop, and the other for the second crop. But where the water-supply in the well is abundant and the area attached to it is very limited, then the same land is utilized for both crops.

(7) The average area irrigated under a well in any one year amounts to 2·85 acres.

35 (1)—It has been seen from actual crop experiments that lands cultivated exclusively under well irrigation generally yield twice as much as lands under tanks or any other direct flow. Hence, if two crops were raised under wells instead of one, the value of the produce will be more than twice as much as that of the produce from lands under tanks or other combined sources.

(2) No valuable crops, such as sugar-cane, betel-leaves, etc., are ever raised in this district exclusively under well irrigation.

(3) (*a*). The average commutation price of the yield, from an acre of land irrigated under wells in a year of ample rainfall, as ascertained from actual crop experiments, is from Rs. 62 to 78, and the yield from an acre of dry land is only from Rs. 6 to 10, as shown above. Hence the increase due to irrigation is from Rs. 56 to 68 per acre.

(*b*) In a year of scanty rainfall the average yield from an acre amounts to Rs. 37 to 52, and thus the increase due to irrigation ranges from Rs. 31 to 42.

(*c*) In a year of drought the average yield is from Rs. 22 to 35, which when compared with the yield from an acre of dry land, gives an increase ranging from Rs. 16 to 25.

36 (1) The increase in the total annual value of the produce per acre, due to well irrigation, as actually worked out on the average of a normal term of 5 years, amounts to Rs. 42 *minus* Rs. 8, or Rs. 34.

(2) In a year of drought, the above increase only amounts to Rs. 14 per acre.

37. (*Vide* answers to question 17 *supra*).—The well rates are levied neither on the area actually irrigated under a well, nor on the area commanded by it, but on the area fixed by Government, which is 2 acres per *mot*. For example, if there are four *mots* to a well, and the total irrigated land under it amounts to 10 acres or more, the cultivator has to pay the well rates only on 8 acres.

38. No difficulties of any kind are ordinarily experienced either in the selection of a suitable spot or in the actual construction of a well in this district. Nor is any assistance of Government applied for and obtained by the *raiyats* in the construction of wells.

In very rare instances, the *raiyats*, in the course of digging wells, come in contact with rocky beds which necessitate the seeking of expert advice or the resort to blasting.

39. I am not in favour of the construction by Government of wells in private lands, for, such a step, besides entailing a large amount of capital, will lead to manifold difficulties regarding the regulation of water-supply, the up-keep of the wells and the like; and, after all, the return which then Government will get may not be in any way proportionate to the outlay of its labour and money. Here again I would draw attention to the suggestion submitted in answer to question 32 *supra*.

40. Temporary wells are largely resorted to in years of scanty rainfall, and they actually afford considerable protection against drought. Since the existing rules regarding the sinking of wells are quite liberal and afford sufficient inducement to the *raiyats*, I have nothing more to suggest than what has already been shown in my answer to question 4 *supra*. The number of temporary wells existing in the district at present is 7,807.

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(14) *Memorandum of points to be considered by the Irrigation Commission in Jaipur.*

1. *Total number of works, modern and ancient.*—Total number of irrigation works completed and in progress; are these all storage works or do they include any canal, taking off direct from rivers without storage works? Of the total number how many are old works that have been in operation from time immemorial, and how many are either new or completely restored works carried out since Colonel Jacob went to the State?

2. *Growth of irrigated areas.*—Total areas in acres recorded as irrigated by the State works for each year from 1872, so as to shew progress of irrigation.

3. *Particulars for typical works.*—The following particulars in regard to a few typical works:—

I.—Initial statistics—

Area and nature of catchment.

Assumed average annual rainfall.

Full supply capacity of tank in m. c. feet.

Percentage of capacity on assumed average rainfall.

Water spread at full supply.

Maximum height and total length of dam.

Cost of dam, waste weir, sluices.

Compensation for land submerged by tank.

Cost of canal and distributing channels.

Total capital cost.

II.—Annual statistics for each year since completion—

Rainfall of the year.

Amount stored during year.

Amount run over waste weir.

Total run off for the year.

Percentage of run off on rainfall of the year.

Area irrigated during the year in acres.

Quantity of water if any left in tank at end of irrigating season and available for next year.

4. *Annual expenditure.*—Can total expenditure on all works recorded since 1872 (about 58 lakhs) be distributed between (1) capital outlay and (2) cost of maintenance and repairs? Do the charges shown, either as capital outlay or

on maintenance include cost of all establishments, including share of Executive Engineer's and Superintending Engineer's pay, and also the cost of revenue collection?

5. *Revenue.*—Scale of water rates for flow and lift—single and double crops, etc. Is this uniform for all works, and independent of the number of waterings given? Are remissions of water rate given when crops fail to come to maturity? How is the rate levied? Is it taken at the same time as the share of produce?

How is share of produce taken? Is it taken in kind or at a cash valuation? If so, how is the cash value determined, and what is the share taken?

In case of jagir lands, does the State only get the water rate? Do Jagirdars contribute anything towards the cost of the works?

Do not the amounts shown as revenue in the annual reports include under "share of produce" a certain amount of revenue which was realizable before the construction of the works, or are the whole amounts shown fairly and entirely creditable to the works?

6. *Distribution and duty.*—What are the crops mainly irrigated, and how many waterings do they usually receive? During what period is water given out, and how is the distribution controlled and the duration of times of each cultivator determined? What is considered a fair average duty per million cubic feet stored, including losses by evaporation, absorption, etc.?

7. *Black cotton soil.*—Experience as regards black soil. Do small tanks constructed in such soil hold water, and can high earthen dams be made of it without masonry core walls? When the land irrigated is a black soil, is there any demand for water during seasons of average rainfall or only in case of prolonged drought? In such soils does the irrigated area show a falling off in years of fair or good rainfall owing to slack demand, and is the revenue more precarious on this account than on tanks commanding other classes of soil? Has there been a desire for irrigation works on the part of owners of black soil, and is the construction of tanks for such soil considered as remunerative or as important as for other classes of soil?

8. *Future extensions.*—Apart from the enlargement and improvement of existing works, are any new works of considerable size proposed or considered possible in Jaipur? If so, in what tracts, and what would be the probable area of new irrigation? Is the field for new works restricted because their construction would seriously interfere with the supply to existing works within the State. Are there any possible irrigation projects, the construction of which would benefit the State, but cannot be contemplated owing to objections that may be raised by neighbouring States, to interference with the water-supply, or to the necessity of carrying the channels through the territory of another State?

9. *Relief works.*—What were the works on which relief labour was mainly employed during late famine? Were any new irrigation works commenced and completed, or if not completed, is it now proposed to complete them? Can useful employment be found for relief labour in improving or strengthening existing works or on the construction of proposed new works, and are any programmes of possible irrigation relief works maintained?

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(15) *Memorandum of points to be considered by the Irrigation Commission in Hyderabad and Mysore.*

1. *Population, areas, etc.*—The population, and gross culturable and average cropped areas, in each district or division, and the area irrigated in (i) a normal year, (ii) in a year of drought by State irrigation works, private or village works, and wells respectively?

2. *Soils.*—General character of the soil. Brief description of each important class of soil and of its distribution over the country. General experience as to irrigation requirements of different soils.

3. *Black cotton soil.*—Experience as regards black soil. Do small tanks constructed in such soil hold water, and can high earthen dams be made of it without a masonry core wall? When the land irrigated is a black soil, is there any demand for water during the seasons of average rainfalls, or only in case of prolonged drought? In such soil does the irrigated area show a falling off in years of fair or good rainfall owing to slack demand, and is the revenue more precarious on this account than on works commanding other classes of soil? Has there been a desire for irrigation works on the part of owners of black soil, and is the construction of works for such soil considered as remunerative or as important as for other classes of soil?

4. *State irrigation works.*—Number and description of the State irrigation works and their total capital cost. Total area irrigated by the works (i) in a dry year, (ii) in a normal year. Average annual working expenses and total and net revenue. Are these works to be depended on in a season of drought?

5. *Future extensions.*—Are any new works of considerable size proposed or considered possible in the State? If so, in what tracts and what would be the probable area of new irrigation?

6. *Village or private irrigation works, excluding wells.*—Are there any village or private irrigation works excluding wells? If so, by whom are they constructed and maintained? Number of such works and aggregate extent of cultivation dependent on them. Is any expenditure incurred by the State on these works, or any increase in revenue, direct or indirect, derived from them?

Is there any considerable scope for the construction of new works of this class? If so, in what tracts, and what would be the probable area of new irrigation?

7. *Crop irrigated. Distribution and duty.*—What are the crops usually irrigated in each season by (i) canals, (ii) tanks and (iii) wells? How many waterings do they usually require? During what period is water given out? How is the distribution from (i) and (ii) controlled and the time for which water is allotted to each cultivator determined? What is considered a fair average duty per cubic foot per second of discharge or per million cubic feet stored, including loss by evaporation, absorption, etc.?

8. *Statistics for typical works.*—Statistical information regarding some of the larger or typical storage works.

I.—Initial statistics—

- Area and nature of catchment.
- Assumed average annual rainfall.
- Full supply capacity of tank in m. c. feet.
- Percentage of capacity on assumed average rainfall.
- Water spread at full-supply.
- Maximum height and total length of dam.
- Cost of dam, waste weir, sluices.
- Compensation for land submerged by tank.
- Cost of canal and distributing channels.
- Total capital cost.

II.—Annual statistics for each year since completion—

- Rainfall of the year.
- Amount stored during year.
- Amount run over waste weir.
- Total run off for the year.
- Percentage of run off on rainfall of the year.
- Area irrigated during the year in acres.
- Quantity of water, if any, left in tank at end of irrigating season and available for next year.

9. *Flood protection and drainage works.*—Districts in which flood protection or drainage works are required. Are these of sufficient urgency to be carried out whenever funds may be available, or may they be reserved for the employment of relief labour? Would such works lead to any increase or prevent any loss of land-revenue, or are they recommended only on sanitary grounds or as a means of employment for relief labour?

10. *Relief works.*—On what classes of work was relief labour mainly employed during the late famine. Were any new irrigation works commenced and completed, or if not completed, is it now proposed to complete them?

Memorandum of points to be considered by the Irrigation Commission in Central India.

1. *Population and area.*—Population and gross area of State; cultivated or occupied areas; average area annually under crop; areas irrigated respectively by State works, private or village works, and wells in (1) a normal year and (2) a year of drought.

2. *Physical features, soils, rainfall, etc.*—General configuration of the character of the soils, and their suitability for irrigation. If any black cotton soils, where prevalent; usual depth; nature of the underlying stratum; is there any desire on the part of the cultivators for the irrigation of such soils? Statistics of rainfall.

3. *Crops, etc.*—Staple crops grown in each main class of soil; times at which sown and reaped. What are the crops which require irrigation; how many waterings do they require and at what times of the year? Rental of irrigated and unirrigated lands. Is the State's share taken in cash or as a share of the produce? If the latter, is it taken in kind or at a cash valuation?

4. *Famines.*—Years in which reliable records show that there has been (1) famine and (2) scarcity not amounting to famine. Areas most liable to famine.

5. *State irrigation works.*—Total number and cost of State irrigation works, completed and in progress. Are these all storage works, or do they include any canals taking off direct from rivers without storage works? General financial and protective results attained. Form in which irrigation revenue is realized by the State. Scale of water-rates for flow and lift, single and double crops. Are remissions of water-rate given when crops fail to come to maturity? Arrangements for maintenance of the works, and for the distribution of the water. Do the works irrigate *jagir* lands; if so, to what extent, and on what terms is the water given? Possibility of improving existing works, and possible increase in the area irrigated.

6. *Proposed new State works.*—List of proposed new State works, probable cost, and probable area of new irrigation. Scope for works other than those which have been proposed. Is the field for new works restricted owing to objections that may be raised by neighbouring States to interference with the water supply, or owing to the necessity of carrying the channels through the territory of another State?

7. *Private irrigation works other than wells.*—Brief description of such works, including works in *jagir* lands; state of repair; their liability to failure. Obstacles, if any, to their extension and possibility of stimulating their construction in tracts liable to famine.

8. *Wells.*—Average depth of water below ground surface; cost of wells used for irrigation; total number of such wells; average area irrigated per well. Extent to which the supply of water is affected by drought. Concessions given to the constructors of new wells. Amount of loans advanced by the State during the past 10 years for the construction of wells and other irrigation works and the terms upon which such loans have been given.

9. *Field embankments.*—Are embankments made by the cultivators for the purpose of holding up water to moisten the soil? If so, to what classes of soil and crops are they found to be most suitable? Their effect in (1) increasing the outturn in ordinary years; (2) ensuring a crop in a year of drought; (3) eradicating or preventing the growth of *kans* grass and weeds; (4) rendering the crop more liable to rust in wet years.

10. *Relief works.*—What were the works on which relief labour was mainly employed during the late famine? Were any new irrigation works commenced and completed, or if not completed, is it now proposed to complete them? Can useful employment be found for relief labour in improving or strengthening existing works, or on the construction of proposed new works? Are any programmes of relief works maintained? Suitability or otherwise of field embankments for the employment of relief labour.